Special Second Edition for Chalk Dust Company

PREALGEBRA

COMPLETE STUDENT SOLUTIONS MANUAL

Aufmann | Barker | Lockwood

CHALK DUST COMPANY

Prealgebra Corrections and Clarifications (new program from March 2002)

Solutions Guide, Section 1.2, page 7, problem 41. The value for "c" from the textbook is 7,038 and it was incorrectly reflected in the solutions guide as 48,441. The total for a + b + c should be 56,010.

Prealgebra Corrections and Clarifications (old program up through Feb 2002)

Is a graphing calculator needed for Prealgebra? No, the need for a graphing calculator at the Prealgebra level is marginal. But if the student plans to attend college in the sciences we would recommend the TI-83 or TI-83 plus, because it will be needed in future math and physics courses. It is powerful, user friendly, and comes with an easy to navigate guidebook.

Section 1.1, margin exercise #13. The 6 on the right side of the equation should be a 5.

Section 1.5, problem 35. The trick to working problems 21-40 on page 60 is to re-write the number as the product of several factors. On all of these the same little factor is used over and over. To find the factor and to find out how many times it is used, try to divide some small numbers into the number given. If the division goes evenly, then you can re-write the number as a product of two other numbers. For #35, a little trial and error will reveal that 3 goes into 243 evenly and it goes 81 times; that means 243 can be written as 3 times 81. Then you look at the 81 factor to see if you can break it down by dividing by 3, and so on like this.

243 = 3 (81)
243 = 3 (3) (27)
243 = 3 (3) (3) (9)
243 = 3 (2) (3) (3) (3)
243 = 3^5

Section 4.6, problem 31. The answer in the back of the textbook (1 inch for the width; 2.5 inch for the length) is incorrect. The answer in the solutions guide (3 inch for the width; 7.5 inch for the length) is correct.

Section 5.2, problem 25. Think of the number next to a letter as telling you how many of that letter you have; 5x means you have five x's, 0.03x means you have 0.03 x's, and when you have just x, well, you have one x. In 0.03x - x, you think of it as 0.03x - 1x and to bring them together you collect the numbers next to the x's, or (0.03 - 1) x, which is -0.97x.

Chapter 8, Chapter Test, problem 19. The problem is listed differently in the text and the solutions guide. The bottom polynomial should read 5x - 4, and not 5x -4 + 2^2.

PREALGEBRA

COMPLETE STUDENT SOLUTIONS MANUAL

Richard N. Aufmann
Palomar College

Vernon C. Barker
Palomar College

Joanne S. Lockwood
Plymouth State College

Special Second Edition
for Chalk Dust Company

HOUGHTON MIFFLIN COMPANY
Boston New York

Senior Sponsoring Editor: Lynn Cox
Senior Development Editor: Dawn Nuttall
Senior Manufacturing Coordinator: Marie Barnes
Editorial Assistant: Melissa Parkin
Marketing Manager: Ben Rivera

Custom Publishing Editor: Kyle Henderson
Custom Publishing Production Manager: Kathleen McCourt
Custom Publishing Production Coordinator: Kyle Sarofeen

Cover Designer: Kelly Mannion
Cover Photograph: Photodisc, Inc.

Printed in the United States of America.

ISBN: 0-618-24994-X
N-00884

1 2 3 4 5 6 7 8 9 – CCI – 05 04 03 02

Houghton Mifflin
Custom Publishing

222 Berkeley Street · Boston, MA 02116

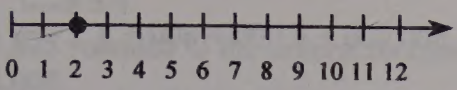
Address all correspondence and order information to the above address.

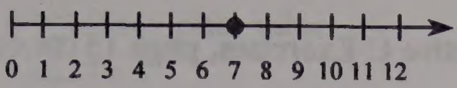
Contents

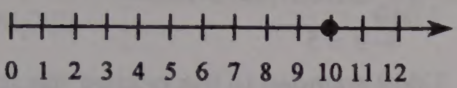
Chapter 1

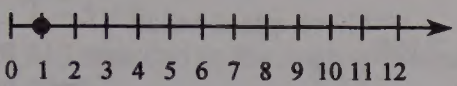
Section 1.1

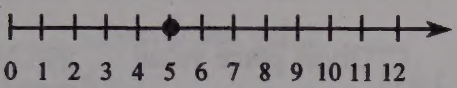
Objective A Exercises, pages 13–14

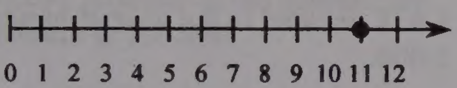
3. 

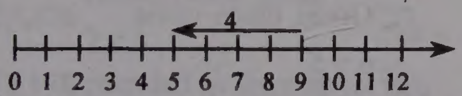
4. 

5. 

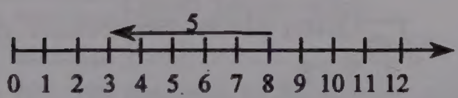
6. 

7. 

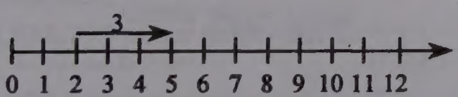
8. 

9. 

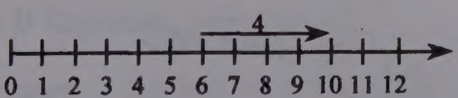
   5 is 4 units to the left of 9.

10. 

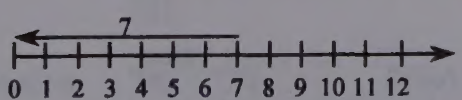
   3 is 5 units to the left of 8.

11. 

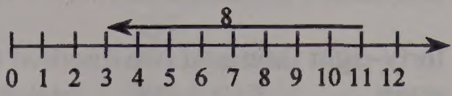
   5 is 3 units to the right of 2.

12. 

   10 is 4 units to the right of 6.

13. 

   0 is 7 units to the left of 7.

14. 

   3 is 8 units to the left of 11.

15. $27 < 39$
16. $68 > 41$
17. $0 < 52$
18. $61 > 0$
19. $273 > 194$
20. $419 < 502$
21. $2{,}761 < 3{,}857$
22. $3{,}827 < 6{,}915$
23. $4{,}610 > 4{,}061$
24. $5{,}600 < 56{,}000$
25. $8{,}005 < 8{,}050$
26. $92{,}010 > 92{,}001$
27. 11, 14, 16, 21, 32
28. 18, 27, 35, 60, 71
29. 13, 48, 72, 84, 93
30. 28, 45, 54, 63, 109
31. 26, 49, 77, 90, 106
32. 155, 271, 358, 496, 505
33. 204, 399, 662, 736, 981
34. 400, 404, 440, 444, 4,000
35. 307, 370, 377, 3,077, 3,700

Objective B Exercises, pages 14–15

36. seven hundred four
37. five hundred eight
38. three hundred seventy-four
39. six hundred thirty-five

40. two thousand eight hundred sixty-one

41. four thousand seven hundred ninety

42. forty-eight thousand two hundred ninety-seven

43. fifty-three thousand six hundred fourteen

44. five hundred sixty-three thousand seventy-eight

45. two hundred forty-six thousand fifty-three

46. six million three hundred seventy-nine thousand four hundred eighty-two

47. three million eight hundred forty-two thousand nine hundred five

48. 75

49. 496

50. 2,851

51. 53,340

52. 130,212

53. 502,140

54. 8,073

55. 9,706

56. 603,132

57. 5,012,907

58. 3,004,008

59. 8,005,010

60. $6{,}000 + 300 + 90 + 8$

61. $7{,}000 + 200 + 40 + 5$

62. $40{,}000 + 6{,}000 + 100 + 80 + 2$

63. $500{,}000 + 30{,}000 + 2{,}000 + 700 + 90 + 1$

64. $300{,}000 + 20{,}000 + 8{,}000 + 400 + 70 + 6$

65. $5{,}000 + 60 + 4$

66. $90{,}000 + 800 + 30 + 4$

67. $20{,}000 + 300 + 90 + 7$

68. $400{,}000 + 600 + 30 + 5$

69. $400{,}000 + 2{,}000 + 700 + 8$

70. $500{,}000 + 4{,}000 + 600 + 3$

71. $8{,}000{,}000 + 300 + 10 + 6$

Objective C Exercises, page 15

72. 3,049 Given place value
$9 > 5$
3,049 rounded to the nearest ten is 3,050.

73. 7,108 Given place value
$8 > 5$
7,108 rounded to the nearest ten is 7,110.

74. 1,638 Given place value
$3 < 5$
1,638 rounded to the nearest hundred is 1,600.

75. 4,962 Given place value
$6 > 5$
4,962 rounded to the nearest hundred is 5,000.

76. 17,639 Given place value
$3 < 5$
17,639 rounded to the nearest hundred is 17,600.

77. 28,551 Given place value
$5 = 5$
28,551 rounded to the nearest hundred is 28,600.

78. 5,326 Given place value
$3 < 5$
5,326 rounded to the nearest thousand is 5,000.

79. 6,808 Given place value
$8 > 5$
6,809 rounded to the nearest thousand is 7,000.

80. 84,608 Given place value
6 > 5
84,608 rounded to the nearest thousand is 85,000.

81. 93,825 Given place value
8 > 5
93,825 rounded to the nearest thousand is 94,000.

82. 389,702 Given place value
7 > 5
389,702 rounded to the nearest thousand is 390,000.

83. 629,513 Given place value
5 = 5
629,513 rounded to the nearest thousand is 630,000.

84. 746,898 Given place value
6 > 5
746,898 rounded to the nearest ten-thousand is 750,000.

85. 352,876 Given place value
2 < 5
352,876 rounded to the nearest ten-thousand is 350,000.

86. 36,702,599 Given place value
7 > 5
36,702,599 rounded to the nearest million is 37,000,000.

87. 71,834,250 Given place value
8 > 5
71,834,250 rounded to the nearest million is 72,000,000.

Objective D Exercises, pages 16–18

88. Strategy To find the person with the greater number of stolen bases, compare the numbers 743 and 738.

Solution 743 > 738
Eddie Collins had the greater number of stolen bases.

89. Strategy To find the person with the greater number of stolen bases, compare the numbers 892 and 937.

Solution 892 < 937
Billy Hamilton had the greater number of stolen bases.

90. Strategy
a. To find the annual per capita turkey consumption in the U.S., use the pictogram to count each symbol to the right of U.S. as 2 lb.

b. To determine in which country the annual per capita turkey consumption is highest, use the pictogram to determine which country has the most symbols to its right.

Solution
a. The annual per capita turkey consumption in the U.S. is 18 lb.

b. The country with the highest annual per capita turkey consumption is Israel.

91. Strategy To find the greater number of performances, compare the numbers 2,844 and 3,242.

Solution 2,844 < 3,242
"Fiddler on the Roof" was performed the greater number of times.

92. Strategy To find the greater number of performances, compare the numbers 2,377 and 2,717.

Solution 2,377 < 2,717
"My Fair Lady" was performed the greater number of times.

93. Strategy To find the food which contains more calories, compare the numbers 190 and 114.

Solution 190 > 114
Two tablespoons of peanut butter contain more calories.

94. Strategy To determine which invention was patented first, compare the numbers 1892 and 1844.

Solution $1892 > 1844$
The telegraph received the first patent.

95. Strategy To find the shorter distance, compare the two numbers 1,892 and 1,833.

Solution $1{,}892 > 1{,}833$
The shorter distance is from St. Louis to San Diego.

96. Strategy
a. To determine the most often mentioned complaint, find the complaint with the largest number of responses.

b. To determine the least often mentioned complaint, find the complaint with the smallest number of responses.

Solution
a. The complaint with the largest number of responses is people talking.
The most often mentioned complaint is people talking.

b. The complaint with the smallest number of responses is uncomfortable seats.
The least often mentioned complaint was uncomfortable seats.

97. Strategy To find the smaller planet, compare the two numbers 32,200 and 30,800.

Solution $32{,}200 > 30{,}800$
Neptune is the smallest planet.

98. Strategy To find the larger moon, compare the two numbers 4,890 and 5,216.

Solution $4{,}890 < 5{,}216$
Ganymede is the larger moon.

99. Strategy
a. To determine the length of the State of the Union Address in 1995, read the number in the bar graph above the 1995 bar.

b. To determine during which year the length of the State of the Union Address was longest, use the bar graph to find the year with the largest number above its corresponding bar.

Solution
a. The length of the State of the Union Address in 1995 was 81 minutes.

b. The largest number appears above the bar corresponding to 2000.
The year in which the State of the Union Address was longest in 2000.

100. Strategy To find the land area to the nearest thousand square miles, round 570,833 to the nearest thousand.

Solution 570,833 rounded to the nearest thousand is 571,000.
To the nearest thousand square miles, the land area of Alaska is 571,000 mi^2.

101. Strategy To find the land area to the nearest ten-thousand acres, round 161,546 to the nearest ten-thousand.

Solution 161,546 rounded to the nearest ten-thousand is 160,000.
To the nearest ten-thousand acres, the land area of the Appalachian Trail is 160,000 acres.

102. Strategy

a. To determine which was greater, the number of crashes in July or October, use the Number of Crashes category of the bar graph to read the number above the corresponding bar that is greater.

b. To determine which was fewer, the number of vehicles involved in crashes in July or December, use the Number of Vehicles category of the bar graph to read the number above the corresponding bar that is fewer.

Solution

a. The number of crashes in July was 3,459 and the number of crashes in October was 3,344. The greater number of crashes was in July.

b. The number of vehicles involved in crashes in July was 5,210 and 5,242 in December. There were fewer vehicles involved in crashes in July.

103. Strategy

a. To determine during which school year enrollment was lowest, use the line graph to find the school year corresponding to the lowest point on the line.

b. To determine if enrollment increased or decreased between 1975 and 1980, read the graph at 1975 and at 1980.

Solution

a. Student enrollment was lowest during the 1985 school year.

b. Enrollment was less in 1980 than in 1975. Enrollment decreased between 1975 and 1980.

104. Strategy To find the estimate of the cruising speed of a Boeing 747, round the speed (589) to the nearest ten.

Solution 589 rounded to the nearest ten is 590.
To the nearest ten, the speed of a Boeing 747 is 590 mph.

105. Strategy To find the estimate of the speed of light, round the speed (299,800) to the nearest thousand.

Solution 299,800 rounded to the nearest thousand is 300,000.
To the nearest thousand, the speed of light is 300,000 km/s.

Critical Thinking 1.1, page 18

106. Asia (17,266,000 mi^2)
Africa (11,667,000 mi^2)
North America (9,355,000 mi^2)
South America (6,878,000 mi^2)
Antarctica (5,500,000 mi^2)
Europe (4,056,000 mi^2)
Australia (2,966,144 mi^2)

Pacific (63,855,000 mi^2)
Atlantic (31,744,000 mi^2)
Indian (28,371,000 mi^2)
Arctic (5,427,000 mi^2)

107. The largest three-digit number is 999. (The next largest whole number is 1,000, which has four digits.) The smallest five-digit number is 10,000. (The next smallest whole number if 9,999, which has 4 digits.)

Section 1.2

Objective A Exercises, pages 35-37

3. $$\begin{array}{r} 732,453 \\ +651,206 \\ \hline 1,383,659 \end{array}$$

4. $$\begin{array}{r} 563,841 \\ +726,053 \\ \hline 1,289,894 \end{array}$$

5. $$\begin{array}{r} 1\ 1\ 1 \\ 2,879 \\ +3,164 \\ \hline 6,043 \end{array}$$

6. $$\begin{array}{r} 1\ \ 11 \\ 9,857 \\ +\ 1,264 \\ \hline 11,121 \end{array}$$

7. $$\begin{array}{r} \scriptstyle 1\,1\ \ 1 \\ 45{,}825 \\ +\,66{,}327 \\ \hline 112{,}152 \end{array}$$

8. $$\begin{array}{r} \scriptstyle 1\,1 \\ 56{,}442 \\ +\,71{,}289 \\ \hline 127{,}731 \end{array}$$

9. $$\begin{array}{r} \scriptstyle 1\,1 \\ 4{,}037 \\ 3{,}342 \\ +\,5{,}169 \\ \hline 12{,}548 \end{array}$$

10. $$\begin{array}{r} \scriptstyle 1\ 1\ 1 \\ 5{,}242 \\ 7{,}883 \\ +\,4{,}165 \\ \hline 17{,}290 \end{array}$$

11. $$\begin{array}{r} \scriptstyle 1\,1\,1 \\ 67{,}390 \\ 42{,}761 \\ +\,89{,}405 \\ \hline 199{,}556 \end{array}$$

12. $$\begin{array}{r} \scriptstyle 2\,2 \\ 34{,}801 \\ 97{,}302 \\ +\,68{,}945 \\ \hline 201{,}048 \end{array}$$

13. $$\begin{array}{r} \scriptstyle 2\ 1\ 1\ 2 \\ 54{,}097 \\ 33{,}432 \\ 97{,}126 \\ 64{,}508 \\ 78{,}310 \\ \hline 327{,}473 \end{array}$$

14. $$\begin{array}{r} \scriptstyle 2\ 2\ 2\ 1 \\ 23{,}086 \\ 44{,}697 \\ 67{,}302 \\ 83{,}441 \\ +\,19{,}843 \\ \hline 238{,}369 \end{array}$$

15. $$\begin{array}{r} 88{,}123 \\ +\,80{,}451 \\ \hline 168{,}574 \end{array}$$

16. $$\begin{array}{r} 82{,}003 \\ +\,44{,}765 \\ \hline 126{,}768 \end{array}$$

17. $$\begin{array}{r} \scriptstyle 1 \\ 7{,}293 \\ +\,654 \\ \hline 7{,}947 \end{array}$$

18. $$\begin{array}{r} \scriptstyle 2\ 1\ 2 \\ 658 \\ 2{,}709 \\ +\,10{,}935 \\ \hline 14{,}302 \end{array}$$

19. $$\begin{array}{r} \scriptstyle 1\ \ 1 \\ 216 \\ 8{,}707 \\ +\,90{,}714 \\ \hline 99{,}637 \end{array}$$

20. $x + y$

21. $$\begin{array}{r} 585 \\ 497 \\ 412 \\ +\,378 \\ \hline 1{,}872 \end{array}$$

The total number of undergraduates enrolled at the college in 2001 was 1,872.

22. $$\begin{array}{r} 613 \\ 478 \\ 423 \\ +\,396 \\ \hline 1{,}910 \end{array}$$

The total number of undergraduates enrolled at the college in 2002 was 1,910.

23. $$\begin{array}{rcr} 6{,}742 & \rightarrow & 7{,}000 \\ +\,8{,}298 & \rightarrow & +\,8{,}000 \\ \hline 15{,}040 & & 15{,}000 \end{array}$$

24. $$\begin{array}{rcr} 5{,}426 & \rightarrow & 5{,}000 \\ +\,1{,}732 & \rightarrow & +\,2{,}000 \\ \hline 7{,}158 & & 7{,}000 \end{array}$$

25. $$\begin{array}{rcr} 972{,}085 & \rightarrow & 1{,}000{,}000 \\ +\,416{,}832 & \rightarrow & +\,400{,}000 \\ \hline 1{,}388{,}917 & & 1{,}400{,}000 \end{array}$$

26. $$\begin{array}{rcr} 23{,}774 & \rightarrow & 20{,}000 \\ +\,38{,}026 & \rightarrow & +\,40{,}000 \\ \hline 61{,}800 & & 60{,}000 \end{array}$$

27. $$\begin{array}{rcr} 387 & \rightarrow & 400 \\ 295 & \rightarrow & 300 \\ 614 & \rightarrow & 600 \\ +\,702 & \rightarrow & +\,700 \\ \hline 1{,}998 & & 2{,}000 \end{array}$$

28.
$$\begin{array}{rcr} 528 & \rightarrow & 500 \\ 163 & \rightarrow & 200 \\ 947 & \rightarrow & 900 \\ +275 & \rightarrow & +300 \\ \hline 1{,}913 & & 1{,}900 \end{array}$$

29.
$$\begin{array}{rcr} 224{,}196 & \rightarrow & 200{,}000 \\ 7{,}074 & \rightarrow & 7{,}000 \\ +98{,}531 & \rightarrow & +100{,}000 \\ \hline 329{,}801 & & 307{,}000 \end{array}$$

30.
$$\begin{array}{rcr} 1{,}607 & \rightarrow & 2{,}000 \\ 873{,}925 & \rightarrow & 900{,}000 \\ +28{,}744 & \rightarrow & +30{,}000 \\ \hline 904{,}276 & & 932{,}000 \end{array}$$

31. $x + y$

$574 + 698$
$$\begin{array}{r} 1\,1 \\ 574 \\ +698 \\ \hline 1{,}272 \end{array}$$

32. $x + y$

$359 + 884$
$$\begin{array}{r} 1\,1 \\ 359 \\ +884 \\ \hline 1{,}243 \end{array}$$

33. $x + y$

$4{,}752 + 7{,}398$
$$\begin{array}{r} 1\,1\,1 \\ 4{,}752 \\ +7{,}398 \\ \hline 12{,}150 \end{array}$$

34. $x + y$

$6{,}047 + 9{,}283$
$$\begin{array}{r} 1\,1 \\ 6{,}047 \\ +9{,}283 \\ \hline 15{,}330 \end{array}$$

35. $x + y$

$38{,}229 + 51{,}671$
$$\begin{array}{r} 11 \\ 38{,}229 \\ +51{,}671 \\ \hline 89{,}900 \end{array}$$

36. $x + y$

$74{,}376 + 19{,}528$
$$\begin{array}{r} 1\quad 11 \\ 74{,}376 \\ +19{,}528 \\ \hline 93{,}904 \end{array}$$

37. $a + b + c$

$693 + 508 + 371$
$$\begin{array}{r} 1\,1 \\ 693 \\ 508 \\ +371 \\ \hline 1{,}572 \end{array}$$

38. $a + b + c$

$177 + 892 + 405$
$$\begin{array}{r} 1\,1 \\ 177 \\ 892 \\ +405 \\ \hline 1{,}474 \end{array}$$

39. $a + b + c$

$4{,}938 + 2{,}615 + 7{,}038$
$$\begin{array}{r} 1\quad 2 \\ 4{,}938 \\ 2{,}615 \\ +7{,}038 \\ \hline 14{,}591 \end{array}$$

40. $a + b + c$

$6{,}059 + 3{,}774 + 5{,}136$
$$\begin{array}{r} 11 \\ 6{,}059 \\ 3{,}774 \\ +5{,}136 \\ \hline 14{,}969 \end{array}$$

41. $a + b + c$

$12{,}897 + 36{,}075 + 48{,}441$
$$\begin{array}{r} 1\,1\;\;21 \\ 12{,}897 \\ 36{,}075 \\ +48{,}441 \\ \hline 97{,}413 \end{array}$$

42. $a + b + c$

$52{,}847 + 49{,}036 + 24{,}717$
$$\begin{array}{r} 11\;12 \\ 52{,}847 \\ 49{,}036 \\ +24{,}717 \\ \hline 126{,}600 \end{array}$$

43. The Commutative Property of Addition

44. The Addition Property of Zero

45. The Associative Property of Addition

46. The Commutative Property of Addition

47. The Addition Property of Zero

48. The Associative Property of Addition

49. $28 + 0 = 28$

50. $16 + 7 = 7 + 16$

51. $9 + (4 + 17) = (9 + 4) + 17$

52. $0 + 51 = 51$

53. $15 + 34 = 34 + 15$

54. $(6 + 18) + 4 = 6 + (18 + 4)$

55. $42 = n + 4$

$$\begin{array}{c|c} 42 & 38+4 \end{array}$$

$42 = 42$

Yes, 38 is a solution of the equation $42 = n + 4$.

56. $m + 6 = 13$

$$\begin{array}{c|c} 17+6 & 13 \end{array}$$

$23 \neq 13$

No, 17 is not a solution of the equation $m + 6 = 13$.

57. $2 + h = 16$

$$\begin{array}{c|c} 2+13 & 16 \end{array}$$

$15 \neq 16$

No, 13 is not a solution of the equation $2 + h = 16$.

58. $n = 17 + 24$

$$\begin{array}{c|c} 41 & 17+24 \end{array}$$

$41 = 41$

Yes, 41 is a solution of the equation $n = 17 + 24$.

59. $32 = x + 2$

$$\begin{array}{c|c} 32 & 30+2 \end{array}$$

$32 = 32$

Yes, 32 is a solution of the equation $32 = x + 2$.

60. $38 = 11 + z$

$$\begin{array}{c|c} 38 & 11+29 \end{array}$$

$38 \neq 40$

No, 29 is not a solution of the equation $38 = 11 + z$.

Objective B Exercises, pages 37–39

63. $$\begin{array}{r} {\scriptstyle 7\ 13} \\ 8\cancel{8}\cancel{3} \\ -\,467 \\ \hline 416 \end{array}$$

64. $$\begin{array}{r} {\scriptstyle 8\ 11} \\ 5\cancel{9}\cancel{1} \\ -\,238 \\ \hline 353 \end{array}$$

65. $$\begin{array}{r} {\scriptstyle 2\ 15\ 10} \\ \cancel{3}\cancel{6}\cancel{0} \\ -\,172 \\ \hline 188 \end{array}$$

66. $$\begin{array}{r} {\scriptstyle 8\ 14\ 10} \\ \cancel{9}\cancel{5}\cancel{0} \\ -\,483 \\ \hline 467 \end{array}$$

67. $$\begin{array}{r} {\scriptstyle 5\ 15} \\ \cancel{6}\cancel{5}7 \\ -\,193 \\ \hline 464 \end{array}$$

68. $$\begin{array}{r} {\scriptstyle 5\ 12} \\ 7\cancel{6}\cancel{2} \\ -\,659 \\ \hline 103 \end{array}$$

69. $$\begin{array}{r} {\scriptstyle 3\ 9\ 17} \\ \cancel{4}\cancel{0}\cancel{7} \\ -\,199 \\ \hline 208 \end{array}$$

70. $$\begin{array}{r} {\scriptstyle 7\ 9\ 15} \\ \cancel{8}\cancel{0}\cancel{5} \\ -\,147 \\ \hline 658 \end{array}$$

71. $$\begin{array}{r} {\scriptstyle 7\ 10\ 14} \\ 6{,}\cancel{8}\cancel{1}\cancel{4} \\ -\,3{,}257 \\ \hline 3{,}557 \end{array}$$

72. $$\begin{array}{r} {\scriptstyle 6\ 12\ 15\ 11} \\ \cancel{7}{,}\cancel{3}\cancel{6}\cancel{1} \\ -\,4{,}575 \\ \hline 2{,}786 \end{array}$$

73. $$\begin{array}{r} {\scriptstyle 4\ 9\ 9\ 10} \\ \cancel{5}{,}\cancel{0}\cancel{0}\cancel{0} \\ -\,2{,}164 \\ \hline 2{,}836 \end{array}$$

74. $$\begin{array}{r} {\scriptstyle 3\ 9\ 9\ 10} \\ \cancel{4}{,}\cancel{0}\cancel{0}\cancel{0} \\ -\,1{,}873 \\ \hline 2{,}127 \end{array}$$

75. $$\begin{array}{r} {\scriptstyle 2\ 13\ 9\ 10} \\ \cancel{3}{,}\cancel{4}\cancel{0}\cancel{0} \\ -\,1{,}963 \\ \hline 1{,}437 \end{array}$$

76. $\begin{array}{r} {}^{6\;12\;9\;10} \\ 7,300 \\ -\,2,562 \\ \hline 4,738 \end{array}$

77. $\begin{array}{r} {}^{2\;9\;9\;9\;14} \\ 30,004 \\ -\,9,856 \\ \hline 20,148 \end{array}$

78. $\begin{array}{r} {}^{6\;9\;9\;9\;13} \\ 70,003 \\ -\,8,246 \\ \hline 61,757 \end{array}$

79. $\begin{array}{r} {}^{1\;15\;2\;16} \\ 2,536 \\ -\,918 \\ \hline 1,618 \end{array}$

80. $\begin{array}{r} {}^{5\;11\;13} \\ 1,623 \\ -\,287 \\ \hline 1,336 \end{array}$

81. $\begin{array}{r} {}^{0\;12\;7\;9\;14} \\ 12,804 \\ -\,5,426 \\ \hline 7,378 \end{array}$

82. $\begin{array}{r} {}^{7\;9\;11} \\ 14,801 \\ -\,3,522 \\ \hline 11,279 \end{array}$

83. $\begin{array}{r} {}^{7\;14\;13\;11\;13} \\ 85,423 \\ -\,67,875 \\ \hline 17,548 \end{array}$

84. $x-y$

85. $\begin{array}{r} {}^{8\;10} \\ 90 \\ -\,75 \\ \hline 15 \end{array}$

The difference between the maximum heights is 15 ft.

86. $\begin{array}{r} {}^{1\;9\;10} \\ 200 \\ -\,175 \\ \hline 25 \end{array}$

The eruption of the Giant is 25 ft higher than the eruption of Old Faithful.

87. $\begin{array}{rcr} 7,355 & \rightarrow & 7,000 \\ -\,5,219 & \rightarrow & 5,000 \\ \hline 2,136 & & 2,000 \end{array}$

88. $\begin{array}{rcr} 8,953 & \rightarrow & 9,000 \\ -\,2,217 & \rightarrow & 2,000 \\ \hline 6,736 & & 7,000 \end{array}$

89. $\begin{array}{rcr} 59,126 & \rightarrow & 60,000 \\ -\,20,843 & \rightarrow & -\,20,000 \\ \hline 38,283 & & 40,000 \end{array}$

90. $\begin{array}{rcr} 63,051 & \rightarrow & 60,000 \\ 29,478 & \rightarrow & -\,30,000 \\ \hline 33,573 & & 30,000 \end{array}$

91. $\begin{array}{rcr} 36,287 & \rightarrow & 40,000 \\ -5,092 & \rightarrow & -\,5,000 \\ \hline 31,195 & & 35,000 \end{array}$

92. $\begin{array}{rcr} 58,316 & \rightarrow & 60,000 \\ -19,072 & \rightarrow & -20,000 \\ \hline 39,244 & & 40,000 \end{array}$

93. $\begin{array}{rcr} 224,196 & \rightarrow & 200,000 \\ -\,98,531 & \rightarrow & -\,100,000 \\ \hline 125,665 & & 100,000 \end{array}$

94. $\begin{array}{rcr} 873,925 & \rightarrow & 900,000 \\ -\,28,744 & \rightarrow & 30,000 \\ \hline 845,181 & & 870,000 \end{array}$

95. $x-y$

$50-37$

$\begin{array}{r} {}^{4\;10} \\ 50 \\ -37 \\ \hline 13 \end{array}$

96. $x-y$

$80-33$

$\begin{array}{r} {}^{7\;10} \\ 80 \\ -\,33 \\ \hline 47 \end{array}$

97. $x-y$

$914-271$

$\begin{array}{r} {}^{8\;11} \\ 914 \\ -\,271 \\ \hline 643 \end{array}$

98. $x-y$

$623-197$

$\begin{array}{r} {}^{5\;11\;13} \\ 623 \\ -197 \\ \hline 426 \end{array}$

99. $x - y$

$740 - 385$

$$\begin{array}{r} {\scriptstyle 6\ 13\ 10} \\ \cancel{740} \\ -\ 385 \\ \hline 355 \end{array}$$

100. $x - y$

$870 - 243$

$$\begin{array}{r} {\scriptstyle 6\ 10} \\ 8\cancel{70} \\ -243 \\ \hline 627 \end{array}$$

101. $x - y$

$8{,}672 - 3{,}461$

$$\begin{array}{r} 8{,}672 \\ -\ 3{,}461 \\ \hline 5{,}211 \end{array}$$

102. $x - y$

$7{,}814 - 3{,}512$

$$\begin{array}{r} 7{,}814 \\ -\ 3{,}512 \\ \hline 4{,}302 \end{array}$$

103. $x - y$

$1{,}605 - 839$

$$\begin{array}{r} {\scriptstyle 0\ 15\ 9\ 15} \\ \cancel{1{,}605} \\ -\ 839 \\ \hline 766 \end{array}$$

104. $x - y$

$1{,}406 - 968$

$$\begin{array}{r} {\scriptstyle 0\ 13\ 9\ 16} \\ \cancel{1{,}406} \\ -\ 968 \\ \hline 438 \end{array}$$

105. $x - y$

$23{,}409 - 5{,}178$

$$\begin{array}{r} {\scriptstyle 1\ 13\ 3\ 10} \\ \cancel{23{,}409} \\ -\ 5{,}178 \\ \hline 18{,}231 \end{array}$$

106. $x - y$

$56{,}397 - 8{,}249$

$$\begin{array}{r} {\scriptstyle 4\ 16\quad 8\ 17} \\ \cancel{56{,}397} \\ -\ 8{,}249 \\ \hline 48{,}148 \end{array}$$

107. $$\begin{array}{c|c} \multicolumn{2}{c}{29 = 53 - y} \\ \hline 29 & 53 - 24 \end{array}$$

$29 = 29$

Yes, 24 is a solution of the equation $29 = 53 - y$.

108. $$\begin{array}{c|c} 48 - p & = 17 \\ \hline 48 - 31 & 17 \\ 17 & = 17 \end{array}$$

Yes, 31 is a solution of the equation $48 - p = 17$.

109. $$\begin{array}{c|c} t - 16 & = 60 \\ \hline 44 - 16 & 60 \\ 28 & \neq 60 \end{array}$$

No, 44 is not a solution of the equation $t - 16 = 60$.

110. $$\begin{array}{c|c} \multicolumn{2}{c}{34 = x - 9} \\ \hline 34 & 25 - 9 \end{array}$$

$34 \neq 16$

No, 25 is not a solution of the equation $34 = x - 9$.

111. $$\begin{array}{c|c} 82 - z & = 55 \\ \hline 82 - 27 & 55 \\ 55 & = 55 \end{array}$$

Yes, 27 is a solution of the equation $82 - z = 55$.

112. $$\begin{array}{c|c} \multicolumn{2}{c}{72 = 100 - d} \\ \hline 72 & 100 - 28 \end{array}$$

$72 = 72$

Yes, 28 is a solution of the equation $72 = 100 - d$.

Objective C Exercises, pages 39–42

113. Strategy: To find the sum of the whole numbers less than 21, add the numbers 0 to 20.

Solution: $0 + 1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 + 11 + 12 + 13 + 14 + 15 + 16 + 17 + 18 + 19 + 20 = 210$

The sum of the numbers is 210.

114. Strategy To find the sum of the natural numbers greater than 89 and less than 101, add the numbers 90 to 100.

Solution $90 + 91 + 92 + 93 + 94 + 95 + 96 + 97 + 98 + 99 + 100 = 1{,}045$

The sum of the numbers is 1,045.

115. Strategy To find the difference, subtract 99 (the largest two-digit number) from 1,000 (the smallest four-digit number).

Solution

$$\begin{array}{r} 1{,}000 \\ -\ \ 99 \\ \hline 901 \end{array}$$

The difference is 901.

116. Strategy

a. To determine the two-year period during which the smallest increase in the number of people aged 100 and over occurs, find the smallest difference between each two-year period.

b. To determine the two-year period during which the greatest increase in the number of people aged 100 and over occurs, find the largest difference between each two-year period.

Solution
From 2010 to 2012: 146,000 – 129,000 = 17,000
From 2012 to 2014: 166,000 – 146,000 = 20,000
From 2014 to 2016: 187,000 – 166,000 = 21,000
From 2016 to 2018: 208,00 – 187,000 = 21,000
From 2018 to 2020: 235,000 – 208,000 = 27,000

a. The two-year period during which the increase is smallest is 2010 to 2012.

b. The two-year period during which the increase is greatest is 2018 to 2020.

117. Strategy To find the number of calories, add the number of calories in one apple (80), one cup of cornflakes (95), one tablespoon of sugar (45), and one cup of milk (150).

Solution $80 + 95 + 45 + 150 = 370$

The breakfast contained 370 calories.

118. Strategy To determine the number of calories, subtract the number of calories consumed (950) from the daily limit of calories (1,500).

Solution

$$\begin{array}{r} 1{,}500 \\ -950 \\ \hline 550 \end{array}$$

You can consume 550 more calories.

119. Strategy To find the perimeter of a rectangle, replace L with 24 and W with 15 in the given formula and solve for P.

Solution
$P = L + W + L + W$
$P = 24 + 15 + 24 + 15$
$P = 78$
The perimeter is 78 m.

120. Strategy To find the perimeter of a rectangle, replace L with 18 and W with 12 in the given formula and solve for P.

Solution
$P = L + W + L + W$
$P = 18 + 12 + 18 + 12$
$P = 60$
The perimeter is 60 ft.

121. Strategy To find the perimeter of a triangle, replace a, b, and c with 16, 12, and 15 in the given formula and solve for P.

Solution
$P = a + b + c$
$P = 16 + 12 + 15$
$P = 43$
The perimeter is 43 in.

122. Strategy To find the perimeter of a triangle, replace a, b, and c with 36, 48, and 60 in the given formula and solve for P.

Solution $P = a + b + c$
$P = 36 + 48 + 60$
$P = 144$
The perimeter is 144 cm.

123. Strategy To determine the length of the hedge, by finding the perimeter of the playground, replace L with 160 and W with 120 in the given formula and solve for P.

Solution $P = L + W + L + W$
$P = 160 + 120 + 160 + 120$
$P = 560$
The length of the hedge is 560ft.

124. Strategy To determine how many feet of wire fence is needed, by finding the perimeter of the garden, replace L with 20 and W with 14 in the given formula and solve for P.

Solution $P = L + W + L + W$
$P = 20 + 14 + 20 + 14$
$P = 68$
The 68 ft of wire fence should be purchased.

125. Strategy To find the difference in the number of orbits, subtract the number of orbits made by Apollo-Saturn 7 (163) from the number of flights made by Gemini-Titan 7 (206).

Solution

$$\begin{array}{r} 206 \\ -163 \\ \hline 43 \end{array}$$

Gemini-Titan 7 made 43 more orbits than Apollo-Saturn 7.

126. Strategy To find the amount, add the deposit (870) to the balance in the checking account (1,054).

Solution

$$\begin{array}{r} 870 \\ +1,054 \\ \hline 1,924 \end{array}$$

You have \$1,924 in your checking account.

127. Strategy To find the difference in seating capacity, subtract the seating capacity of Fenway Park (33,871) from the seating capacity of the Kingdome (59,720).

Solution

$$\begin{array}{r} 59,720 \\ -33,871 \\ \hline 25,849 \end{array}$$

The difference in seating capacity is 25,849.

128. Strategy To find the total repair bill, add the cost of parts (179), labor (78) and tax (15).

Solution

$$\begin{array}{r} 179 \\ 78 \\ +15 \\ \hline 272 \end{array}$$

The total repair bill is \$272.

129. Strategy To find the total cost of the computer system, add the cost of the operating system (830), the monitor (245), the keyboard (175), and the printer (395).

Solution

$$\begin{array}{r} 830 \\ 245 \\ 175 \\ +395 \\ \hline 1,645 \end{array}$$

The total cost of the computer system is \$1,645.

130. Strategy To find the estimate of the total area:
→Round the area of each lake to ten-thousands.
→Add the rounded numbers.

Solution
$$\begin{array}{rcr} 81,000 & \rightarrow & 80,000 \\ 67,900 & \rightarrow & 70,000 \\ 74,000 & \rightarrow & 70,000 \\ 32,630 & \rightarrow & 30,000 \\ 34,850 & \rightarrow & +30,000 \\ \hline & & 280,000 \end{array}$$

The total area of the Great Lakes is approximately 280,000 mi^2.

131. Strategy To find the estimate of the number of miles driven:
→Round the two readings of the odometer.
→Subtract the rounded reading from the beginning of the year from the rounded reading at the end of the year.

Solution
$$\begin{array}{rcr} 77,912 & \rightarrow & 80,000 \\ 58,376 & \rightarrow & -60,000 \\ \hline & & 20,000 \end{array}$$

The car was driven approximately 20,000 mi during the year.

132. Strategy To determine between which two months car sales decreased the most, find the difference, if there was a decrease, between sales for January and February, February and March, and March and April for 2001 and 2002.

Solution Between January and February, 2001: not a decrease
Between February and March, 2001: not a decrease
Between March and April, 2001: $152 - 126 = 26$
Between January and February, 2002: not a decrease
Between February and March, 2002: $148 - 129 = 19$
Between March and April, 2002: $129 - 111 = 18$
Car sales decreased the most between March and April of 2001. The decrease was 26 cars.

133. Strategy To determine between which two months car sales increased the most, find the difference, if there was an increase, between sales for January and February, February and March, and March and April for 2001 and 2002.

Solution Between January and February, 2001: $132 - 108 = 24$
Between February and March, 2001: $152 - 132 = 20$
Between March and April, 2001: not an increase
Between January and February, 2002: $148 - 101 = 47$
Between February and March, 2002: not an increase
Between March and April, 2002: not an increase
Car sales increased the most between January and February of 2002. The increase was 47 cars.

134. Strategy To determine in which year more cars were sold during the four-month period:
→Find the total number of cars sold during the four months in 2001.
→Find the total number of cars sold during the four months in 2002.
→Compare the two sums.

Solutions 2001: $108 + 132 + 152 + 126 = 518$
2002: $101 + 148 + 129 + 111 = 489$

$518 > 489$
More cars were sold during the four months of 2001.

135. Strategy To find the value of the investment, replace P by 12,500 and I by 775 in the given formula and solve for A.

Solution $A = P + I$
$A = 12{,}500 + 775$
$A = 13{,}275$
The value of the investment is \$13,275.

136. Strategy To find the value of the investment, replace P by 8,800 and I by 484 in the given formula and solve for A.

Solution $A = P + I$
$A = 8{,}800 + 484$
$A = 9{,}284$
The value of the investment is \$9,284.

137. Strategy To find the mortgage loan, replace S by 145,000 and D by 14,500 in the given formula and solve for M.

Solution $M = S - D$
$M = 145{,}000 - 14{,}500$
$M = 130{,}500$
The mortgage loan on the home is \$130,500.

138. Strategy To find the mortgage loan, replace S by 118,000 and D by 23,600 in the given formula and solve for M.

Solution $M = S - D$
$M = 118{,}000 - 23{,}600$
$M = 94{,}400$
The mortgage loan on the home is \$94,400.

139. Strategy To find the ground speed, replace a by 375 and h by 25 in the given formula and solve for g.

Solution $g = a - h$
$g = 375 - 25$
$g = 350$
The ground speed of the airplane is 350 mph.

140. Strategy To find the ground speed, replace a by 425 and h by 15 in the given formula and solve for g.

Solution $g = a - h$
$g = 425 - 15$
$g = 410$
The ground speed of the airplane is 410 mph.

141. Strategy

a. To determine how many drivers were traveling at 70 mph or less, add the numbers traveling 66–70 mph (3,717), 61–65 mph (2,984), and less than 61 mph (2,870).

b. To determine how many drivers were traveling at 76 mph or more, add the numbers traveling 76–80 mph (2,503) and more than 80 mph (1,708).

Solution

a. $3{,}717 + 2{,}984 + 2{,}870 = 9{,}571$
9,571 drivers were traveling at 70 mph or less.

b. $2{,}503 + 1{,}708 = 4{,}211$
4,211 drivers were traveling at 76 mph or more.

142. It is not possible to tell how many motorists were driving at 70 mph. The data shows that 3,717 drivers were traveling at 66–70 mph. The number 3,717 includes the motorists driving at 66–69 mph as well as those driving at 70 mph. We cannot separate those driving at 70 mph from the others.

143. It is not possible to tell how many motorists were driving at less than 70 mph. The data shows that 3,717 drivers were traveling at 66–70 mph. The number 3,717 includes motorists driving at 70 mph as well as those driving less than 70 mph (at speeds of 66–69 mph). We cannot separate those driving at less than 70 mph from those driving at 70 mph

144. Strategy To determine whether more people are driving at or below the posted speed limit of 70 mph or driving above the posted speed limit:

→Find the total number of cars traveling at or below the posted speed limit by adding the numbers traveling at 66–70 mph (3,717), 61–65 mph (2,984), and less than 61 mph (2,870).

→Find the total number of cars driving above the posted speed limit by adding the numbers traveling 71–75 mph (3,651), 76–80 mph (2,503), and more than 80 mph (1,708).

→Compare the two sums.

Solution $3{,}717 + 2{,}984 + 2{,}870 = 9{,}571$
$3{,}651 + 2{,}503 + 1{,}708 = 7{,}862$

$9{,}571 > 7{,}862$
More cars were traveling at or below the posted speed limit.

Critical Thinking 1.2, page 42

145. If you roll two ordinary dice, the possible sums are the numbers 2 (rolling two 1's) through 12 (rolling two 6's). Therefore there are 11 different sums possible.
(The numbers 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12).

146. The two-digit numbers are the numbers 10 through 99.
$99 - 9 = 90.$
There are 90 two-digit numbers.
The three-digit numbers are the numbers 100 through 999. $999 - 99 = 900.$
There are 900 three-digit numbers.

147. a. Substituting any whole number for a in $a - 0 = a$ will result in a true equation.
The statement is always true.

b. Substituting any whole number for a in $a - a = 0$ will result in a true equation.
The statement is always true.

Section 1.3

Objective A Exercise, pages 63–65

3.
$$\begin{array}{r} {\scriptstyle 2\,6\,} \\ 127 \\ \times\ \ 9 \\ \hline 1{,}143 \end{array}$$

4.
$$\begin{array}{r} {\scriptstyle 1\,} \\ 623 \\ \times\ \ 4 \\ \hline 2{,}492 \end{array}$$

5.
$$\begin{array}{r} {\scriptstyle 4\ \ 6\,} \\ 6{,}709 \\ \times\ \ 7 \\ \hline 46{,}963 \end{array}$$

6.
$$\begin{array}{r} {\scriptstyle 3\ \ 4\,} \\ 3{,}608 \\ \times\ \ 5 \\ \hline 18{,}040 \end{array}$$

7.
$$\begin{array}{r} {\scriptstyle 7\,6\ 5\,7\,} \\ 58{,}769 \\ \times\ \ 8 \\ \hline 470{,}152 \end{array}$$

8.
$$\begin{array}{r} {\scriptstyle 3\,4\,} \\ 60{,}047 \\ \times\ \ 7 \\ \hline 420{,}329 \end{array}$$

9.
$$\begin{array}{r} 683 \\ \times\,71 \\ \hline 683 \\ 47\,81 \\ \hline 48{,}493 \end{array}$$

10.
$$\begin{array}{r} 591 \\ \times\,92 \\ \hline 1182 \\ 53\,19 \\ \hline 54{,}372 \end{array}$$

11.
$$\begin{array}{r} 7,053 \\ \times\ 46 \\ \hline 42\ 318 \\ 282\ 12 \\ \hline 324,438 \end{array}$$

12.
$$\begin{array}{r} 6,704 \\ \times\ 58 \\ \hline 53\ 632 \\ 335\ 20 \\ \hline 388,832 \end{array}$$

13.
$$\begin{array}{r} 3,285 \\ \times\ 976 \\ \hline 19\ 710 \\ 229\ 95 \\ 2\ 956\ 5 \\ \hline 3,206,160 \end{array}$$

14.
$$\begin{array}{r} 5,327 \\ \times\ 624 \\ \hline 21\ 308 \\ 106\ 54 \\ 3\ 196\ 2 \\ \hline 3,324,048 \end{array}$$

15. $500 \cdot 3 = 1{,}500$

16. $30 \cdot 80 = 2{,}400$

17. $40 \cdot 50 = 2{,}000$

18. $2 \cdot 700 = 1{,}400$

19. $400 \cdot 3 \cdot 20 \cdot 0 = 1{,}200 \cdot 20 \cdot 0$
$= 24{,}000 \cdot 0$
$= 0$

20. $f \cdot g = fg$

21. $q \cdot r \cdot s = qr \cdot s$
$= qrs$

22. a.
$$\begin{array}{r} 373 \\ \times 6 \\ \hline 2,238 \end{array}$$

You would burn 2,238 calories by working out vigorously on the stair climber for 6 h.

b.
$$\begin{array}{r} 353 \\ \times\ \ 12 \\ \hline 706 \\ 3\ 53 \\ \hline 4,236 \end{array}$$

You would burn 4,236 calories by working out moderately on a treadmill for 12 h.

23. $3{,}467 \rightarrow 3{,}000$
$359 \rightarrow 400$
$3{,}000 \cdot 400 = 1{,}200{,}000$
$3{,}467 \cdot 359 = 1{,}244{,}653$

24. $8{,}745 \rightarrow 9{,}000$
$63 \rightarrow 60$
$9{,}000 \cdot 60 = 540{,}000$
$8{,}745 \cdot 63 = 550{,}935$

25. $39{,}246 \rightarrow 40{,}000$
$29 \rightarrow 30$
$40{,}000 \cdot 30 = 1{,}200{,}000$
$39{,}246 \cdot 29 = 1{,}138{,}134$

26. $64{,}409 \rightarrow 60{,}000$
$67 \rightarrow 70$
$60{,}000 \cdot 70 = 4{,}200{,}000$
$64{,}409 \cdot 67 = 4{,}315{,}403$

27. $745 \rightarrow 700$
$63 \rightarrow 60$
$700 \cdot 60 = 42{,}000$
$745 \cdot 63 = 46{,}935$

28. $432 \rightarrow 400$
$91 \rightarrow 90$
$400 \cdot 90 = 36{,}000$
$432 \cdot 91 = 39{,}312$

29. $8{,}941 \rightarrow 9{,}000$
$726 \rightarrow 700$
$9{,}000 \cdot 700 = 6{,}300{,}000$
$8{,}941 \cdot 726 = 6{,}491{,}166$

30. $2{,}837 \rightarrow 3{,}000$
$216 \rightarrow 200$
$3{,}000 \cdot 200 = 600{,}000$
$2{,}837 \cdot 216 = 612{,}792$

31. ab
$465 \cdot 32 = 14{,}880$

32. cd
$381 \cdot 25 = 9{,}525$

33. $7a$
$7 \cdot 465 = 3{,}255$

34. $6n$
$6 \cdot 382 = 2{,}292$

35. xyz
$5 \cdot 12 \cdot 30 = 60 \cdot 30$
$= 1{,}800$

36. abc
$4 \cdot 20 \cdot 50 = 80 \cdot 50$
$= 4{,}000$

37. $2xy$
$2 \cdot 67 \cdot 23 = 134 \cdot 23$
$= 3{,}082$

38. $4ab$
$4 \cdot 95 \cdot 33 = 380 \cdot 33$
$= 12{,}540$

39. The Multiplication Property of One

40. The Associative Property of Multiplication

41. The Commutative Property of Multiplication

42. The Multiplication Property of Zero

43. $19 \cdot 30 = 30 \cdot 19$

44. $(5 \cdot 6)100 = 5(6 \cdot 100)$

45. $45 \cdot 0 = 0$

46. $1 \cdot 77 = 77$

47. $4x = 24$
$4(6) \mid 24$
$24 = 24$
Yes, 6 is a solution of the equation $4x = 24$.

48. $4 = 4n$
$4 \mid 4(0)$
$4 \neq 0$
No, 0 is not a solution of the equation $4 = 4n$.

49. $96 = 3z$
$96 \mid 3(23)$
$96 \neq 69$
No, 23 is not a solution of the equation $96 = 3z$.

50. $56 = 4c$
$56 \mid 4(14)$
$56 = 56$
Yes, 14 is a solution of the equation $56 = 4c$.

51. $2y = 38$
$2(19) \mid 38$
$38 = 38$
Yes, 19 is a solution of the equation $2y = 38$.

52. $44 = 3a$
$44 \mid 3(11)$
$44 \neq 33$
No, 11 is not a solution of the equation $44 = 3a$.

Objective B Exercises, pages 65–66

53. $2 \cdot 2 \cdot 2 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 = 2^3 \cdot 7^5$

54. $3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 5 \cdot 5 \cdot 5 = 3^6 \cdot 5^3$

55. $2 \cdot 2 \cdot 3 \cdot 3 \cdot 3 \cdot 5 \cdot 5 \cdot 5 \cdot 5 = 2^2 \cdot 3^3 \cdot 5^4$

56. $7 \cdot 7 \cdot 11 \cdot 11 \cdot 11 \cdot 19 \cdot 19 \cdot 19 \cdot 19 = 7^2 \cdot 11^3 \cdot 19^4$

57. $c \cdot c = c^2$

58. $d \cdot d \cdot d = d^3$

59. $x \cdot x \cdot x \cdot y \cdot y \cdot y = x^3y^3$

60. $a \cdot a \cdot b \cdot b \cdot b \cdot b = a^2b^4$

61. $2^5 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 32$

62. $2^6 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 64$

63. $10^6 = 1{,}000{,}000$

64. $10^9 = 1{,}000{,}000{,}000$

65. $2^3 \cdot 5^2 = (2 \cdot 2 \cdot 2) \cdot (5 \cdot 5) = 8 \cdot 25 = 200$

66. $2^4 \cdot 3^2 = (2 \cdot 2 \cdot 2 \cdot 2) \cdot (3 \cdot 3) = 16 \cdot 9 = 144$

67. $3^2 \cdot 10^3 = (3 \cdot 3) \cdot (10 \cdot 10 \cdot 10)$
$= 9 \cdot 1{,}000 = 9{,}000$

68. $2^4 \cdot 10^2 = (2 \cdot 2 \cdot 2 \cdot 2) \cdot (10 \cdot 10)$
$= 16 \cdot 100 = 1{,}600$

69. $0^2 \cdot 6^2 = (0 \cdot 0) \cdot (6 \cdot 6) = 0 \cdot 36 = 0$

70. $4^3 \cdot 0^3 = (4 \cdot 4 \cdot 4) \cdot (0 \cdot 0 \cdot 0) = 64 \cdot 0 = 0$

71. $2^2 \cdot 5 \cdot 3^3 = (2 \cdot 2) \cdot 5 \cdot (3 \cdot 3 \cdot 3)$
$= 4 \cdot 5 \cdot 27 = 20 \cdot 27 = 540$

72. $5^2 \cdot 2 \cdot 3^4 = (5 \cdot 5) \cdot 2 \cdot (3 \cdot 3 \cdot 3 \cdot 3)$
$= 25 \cdot 2 \cdot 81 = 50 \cdot 81 = 4{,}050$

73. $12^2 = 12 \cdot 12 = 144$

74. $6^3 = 6 \cdot 6 \cdot 6 = 36 \cdot 6 = 216$

75. $8^3 = 8 \cdot 8 \cdot 8 = 64 \cdot 8 = 512$

76. $11^2 = 11 \cdot 11 = 121$

77. a^4

78. t^5

79. x^3y
$2^3 \cdot 3 = (2 \cdot 2 \cdot 2) \cdot 3$
$= 8 \cdot 3$
$= 24$

80. x^2y
$3^2 \cdot 4 = (3 \cdot 3) \cdot 4$
$= 9 \cdot 4$
$= 36$

81. ab^6
$5 \cdot 2^6 = 5 \cdot (2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2)$
$= 5 \cdot 64$
$= 320$

82. ab^3
$7 \cdot 4^3 = 7 \cdot (4 \cdot 4 \cdot 4)$
$= 7 \cdot 64$
$= 448$

83. c^2d^2
$3^2 \cdot 5^2 = (3 \cdot 3) \cdot (5 \cdot 5)$
$= 9 \cdot 25$
$= 225$

84. m^3n^3
$5^3 \cdot 10^3 = (5 \cdot 5 \cdot 5)(10 \cdot 10 \cdot 10)$
$= 125 \cdot 1{,}000$
$= 125{,}000$

Objective C Exercises, pages 66–67

87. $\begin{array}{r} 307 \\ 9\overline{)2{,}763} \\ \underline{-27} \\ 6 \\ \underline{-0} \\ 63 \\ \underline{-63} \\ 0 \end{array}$

88. $\begin{array}{r} 540 \\ 4\overline{)2{,}160} \\ \underline{-20} \\ 16 \\ \underline{-16} \\ 0 \\ \underline{-0} \\ 0 \end{array}$

89. $\begin{array}{r} 309 \text{ r } 4 \\ 5\overline{)1{,}549} \\ \underline{-15} \\ 4 \\ \underline{-0} \\ 49 \\ \underline{-45} \\ 4 \end{array}$

90. $\begin{array}{r} 204 \text{ r } 4 \\ 8\overline{)1{,}636} \\ \underline{-16} \\ 3 \\ \underline{-0} \\ 36 \\ \underline{-32} \\ 4 \end{array}$

91. $$\begin{array}{r} 2,550 \\ 6\overline{)\,15,300} \\ \underline{-12} \\ 33 \\ \underline{-30} \\ 30 \\ \underline{-30} \\ 0 \\ \underline{-0} \\ 0 \end{array}$$

92. $$\begin{array}{r} 8,700 \\ 5\overline{)\,43,500} \\ \underline{-40} \\ 35 \\ \underline{-35} \\ 0 \\ \underline{-0} \\ 0 \\ \underline{-0} \\ 0 \end{array}$$

93. $$\begin{array}{r} 21 \text{ r } 9 \\ 32\overline{)\,681} \\ \underline{-64} \\ 41 \\ \underline{-32} \\ 9 \end{array}$$

94. $$\begin{array}{r} 21 \text{ r } 18 \\ 41\overline{)\,879} \\ \underline{-82} \\ 59 \\ \underline{-41} \\ 18 \end{array}$$

95. $$\begin{array}{r} 147 \text{ r } 38 \\ 62\overline{)\,9,152} \\ \underline{-62} \\ 295 \\ \underline{-248} \\ 472 \\ \underline{-434} \\ 38 \end{array}$$

96. $$\begin{array}{r} 180 \text{ r } 21 \\ 23\overline{)\,4,161} \\ \underline{-23} \\ 186 \\ \underline{-184} \\ 21 \\ \underline{-0} \\ 21 \end{array}$$

97. $$\begin{array}{r} 200 \text{ r } 8 \\ 37\overline{)\,7,408} \\ \underline{-74} \\ 0 \\ \underline{-0} \\ 8 \\ \underline{-0} \\ 8 \end{array}$$

98. $$\begin{array}{r} 200 \text{ r } 7 \\ 26\overline{)\,5,207} \\ \underline{-52} \\ 0 \\ \underline{-0} \\ 7 \\ \underline{-0} \\ 7 \end{array}$$

99. $$\begin{array}{r} 404 \text{ r } 34 \\ 78\overline{)\,31,546} \\ \underline{-312} \\ 34 \\ \underline{-0} \\ 346 \\ \underline{-312} \\ 34 \end{array}$$

100. $$\begin{array}{r} 609 \\ 64\overline{)\,38,976} \\ \underline{-384} \\ 57 \\ \underline{-0} \\ 576 \\ \underline{-576} \\ 0 \end{array}$$

101. $$\begin{array}{r} 16 \text{ r } 97 \\ 476\overline{)\,7,713} \\ \underline{-476} \\ 2953 \\ \underline{-2856} \\ 97 \end{array}$$

102. $$\begin{array}{r} 40 \text{ r } 27 \\ 223\overline{)\,8,947} \\ \underline{-8\ 92} \\ 27 \\ \underline{-0} \\ 27 \end{array}$$

103. $$\begin{array}{r} 907 \\ 8\overline{)\,7,256} \\ \underline{-7\,2} \\ 5 \\ \underline{-0} \\ 56 \\ \underline{-56} \\ 0 \end{array}$$

104. $$\begin{array}{r} 908 \\ 9\overline{)\,8,172} \\ \underline{-81} \\ 7 \\ \underline{-0} \\ 72 \\ \underline{-72} \\ 0 \end{array}$$

105. $$\begin{array}{r} 881 \text{ r } 1 \\ 7\overline{)\,6,168} \\ \underline{-56} \\ 56 \\ \underline{-56} \\ 8 \\ \underline{-7} \\ 1 \end{array}$$

106. $$\begin{array}{r} 461 \text{ r } 4 \\ 9\overline{)\,4,153} \\ \underline{-36} \\ 55 \\ \underline{-54} \\ 13 \\ \underline{-9} \\ 4 \end{array}$$

107. $\frac{c}{d}$

108. **a.** $300{,}000 \div 12 = 25{,}000$
The average monthly claim for theft would be \$25,000.

b. $(560{,}000 + 300{,}000 + 80{,}000 + 50{,}000 + 20{,}000 + 20{,}000 + 110{,}000) \div 12 = 95{,}000$
The average claims per month for all sources combined would be \$95,000.

109. $36{,}472 \rightarrow 40{,}000$
$47 \rightarrow 50$
$40{,}000 \div 50 = 800$
$36{,}472 \div 47 = 776$

110. $62{,}176 \rightarrow 60{,}000$
$58 \rightarrow 60$
$60{,}000 \div 60 = 1{,}000$
$62{,}176 \div 58 = 1{,}072$

111. $389{,}804 \rightarrow 400{,}000$
$76 \rightarrow 80$
$400{,}000 \div 80 = 5{,}000$
$389{,}804 \div 76 = 5{,}129$

112. $637{,}072 \rightarrow 600{,}000$
$29 \rightarrow 30$
$600{,}000 \div 30 = 20{,}000$
$637{,}072 \div 29 = 21{,}968$

113. $38{,}984 \rightarrow 40{,}000$
$79 \rightarrow 80$
$40{,}000 \div 80 = 500$
$38{,}984 \div 79 = 493 \text{ r}37$

114. $11{,}792 \rightarrow 10{,}000$
$53 \rightarrow 50$
$10{,}000 \div 50 = 200$
$11{,}792 \div 53 = 222 \text{ r}26$

115. $332{,}004 \rightarrow 300{,}000$
$219 \rightarrow 200$
$300{,}000 \div 200 = 1{,}500$
$332{,}004 \div 219 = 1{,}516$

116. $632{,}124 \rightarrow 600{,}000$
$324 \rightarrow 300$
$600{,}000 \div 300 = 2{,}000$
$632{,}124 \div 324 = 1{,}951$

117. $\frac{x}{y}$
$\frac{48}{1} = 48$

118. $\frac{x}{y}$
$\frac{56}{56} = 1$

119. $\frac{x}{y}$
$\frac{79}{0}$ is undefined, because division by zero is undefined.

120. $\frac{x}{y}$
$\frac{0}{23} = 0$

121. $\frac{x}{y}$

$\frac{39,200}{4}$

$$\begin{array}{r} 9,800 \\ 4\overline{)\,39,200} \\ \underline{-36} \\ 32 \\ \underline{-32} \\ 0 \\ \underline{-0} \\ 0 \\ \underline{-0} \\ 0 \end{array}$$

122. $\frac{x}{y}$

$\frac{16,200}{3}$

$$\begin{array}{r} 5,400 \\ 3\overline{)\,16,200} \\ \underline{-15} \\ 12 \\ \underline{-12} \\ 0 \\ \underline{-0} \\ 0 \\ \underline{-0} \\ 0 \end{array}$$

123. $\frac{36}{z}=4$

$$\begin{array}{c|c} \frac{36}{9} & 4 \end{array}$$

$4=4$

Yes, 9 is a solution of the equation.

124. $\frac{n}{12}=5$

$$\begin{array}{c|c} \frac{60}{12} & 5 \end{array}$$

$5=5$

Yes, 60 is a solution of the equation.

125. $56=\frac{x}{7}$

$$\begin{array}{c|c} 56 & \frac{49}{7} \end{array}$$

$56 \neq 7$

No, 49 is not a solution of the equation.

126. $6=\frac{48}{y}$

$$\begin{array}{c|c} 4 & \frac{48}{16} \end{array}$$

$6 \neq 3$

No, 16 is not a solution of the equation.

Objective D Exercises, page 67 - 68

127. $10 \div 1 = 10$
$10 \div 2 = 5$
$10 \div 5 = 2$
The factors of 10 are 1, 2, 5, and 10.

128. $20 \div 1 = 20$
$20 \div 2 = 10$
$20 \div 4 = 5$
$20 \div 5 = 4$
The factors of 20 are 1, 2, 4, 5, 10, and 20.

129. $12 \div 1 = 12$
$12 \div 2 = 6$
$12 \div 3 = 4$
$12 \div 4 = 3$
The factors of 12 are 1 2, 3, 4, 6, and 12.

130. $9 \div 1 = 9$
$9 \div 3 = 3$
The factors of 9 are 1, 3, and 9.

131. $8 \div 1 = 8$
$8 \div 2 = 4$
$8 \div 4 = 2$
The factors of 8 are 1, 2, 4, and 8.

132. $16 \div 1 = 16$
$16 \div 2 = 8$
$16 \div 4 = 4$
The factors of 16 are 1, 2, 4, 8, and 16.

133. 13 is prime number.
The factors of 13 are 1 and 13.

134. 17 is a prime number.
The factors of 17 are 1 and 17.

135. $18 \div 1 = 18$
$18 \div 2 = 9$
$18 \div 3 = 6$
$18 \div 6 = 3$
The factors of 18 are 1, 2, 3, 6, 9, and 18.

136. $24 \div 1 = 24$
$24 \div 2 = 12$
$24 \div 3 = 8$
$24 \div 4 = 6$
$24 \div 6 = 4$
The factors of 24 are 1, 2, 3, 4, 6, 8, 12, and 24.

137. $25 \div 1 = 25$
$25 \div 5 = 5$
The factors of 25 are 1, 5, and 25.

138. $36 \div 1 = 36$
$36 \div 2 = 18$
$36 \div 3 = 12$
$36 \div 4 = 9$
$36 \div 6 = 6$
The factors of 36 are 1, 2, 3, 4, 6, 9, 12, 18, and 36.

139. $56 \div 1 = 56$
$56 \div 2 = 28$
$56 \div 4 = 14$
$56 \div 7 = 8$
$56 \div 8 = 7$
The factors of 56 are 1, 2, 4, 7, 8, 14, 28, and 56.

140. $45 \div 1 = 45$
$45 \div 3 = 15$
$45 \div 5 = 9$
$45 \div 9 = 5$
The factors of 45 are 1, 3, 5, 9, 15, and 45.

141. $28 \div 1 = 28$
$28 \div 2 = 14$
$24 \div 4 = 7$
$28 \div 7 = 4$
The factors of 28 are 1, 2, 4, 7, 14, and 28.

142. $32 \div 1 = 32$
$32 \div 2 = 16$
$32 \div 4 = 8$
$32 \div 8 = 4$
The factors of 32 are 1, 2, 4, 8, 16, and 32.

143. $48 \div 1 = 48$
$48 \div 2 = 24$
$48 \div 3 = 16$
$48 \div 4 = 12$
$48 \div 6 = 8$
$48 \div 8 = 6$
The factors of 48 are 1, 2, 3, 4, 6, 8, 12, 16, 24, and 48.

144. $64 \div 1 = 64$
$64 \div 2 = 32$
$64 \div 4 = 16$
$64 \div 8 = 8$
The factors of 64 are 1, 2, 4, 8, 16, 32, and 64.

145. $54 \div 1 = 54$
$54 \div 2 = 27$
$54 \div 3 = 18$
$54 \div 6 = 9$
$54 \div 9 = 6$
The factors of 54 are 1, 2, 3, 6, 9, 18, 27, and 54.

146. $75 \div 1 = 75$
$75 \div 3 = 25$
$75 \div 5 = 15$
$75 \div 15 = 5$
The factors of 75 are 1, 3, 5, 15, 25, and 75.

147.
$$\begin{array}{r} 2 \\ 2\overline{)4} \\ 2\overline{)8} \\ 2\overline{)16} \end{array}$$
$16 = 2 \cdot 2 \cdot 2 \cdot 2 = 2^4$

148.
$$\begin{array}{r} 3 \\ 2\overline{)6} \\ 2\overline{)12} \\ 2\overline{)24} \end{array}$$
$24 = 2 \cdot 2 \cdot 2 \cdot 3 = 2^3 \cdot 3$

149.
$$\begin{array}{r} 3 \\ 2\overline{)6} \\ 2\overline{)12} \end{array}$$
$12 = 2 \cdot 2 \cdot 3 = 2^2 \cdot 3$

150.
$$\begin{array}{r} 3 \\ 3\overline{)9} \\ 3\overline{)27} \end{array}$$
$27 = 3 \cdot 3 \cdot 3 = 3^3$

151.
$$\begin{array}{r} 5 \\ 3\overline{)15} \end{array}$$
$15 = 3 \cdot 5$

152.
$$\begin{array}{r} 3 \\ 3\overline{)9} \\ 2\overline{)18} \\ 2\overline{)36} \end{array}$$
$36 = 2 \cdot 2 \cdot 3 \cdot 3 = 2^2 \cdot 3^2$

153. $$\begin{array}{r} 5 \\ 2\overline{)10} \\ 2\overline{)20} \\ 2\overline{)40} \end{array}$$

$40 = 2 \cdot 2 \cdot 2 \cdot 5 = 2^3 \cdot 5$

154. $$\begin{array}{r} 5 \\ 5\overline{)25} \\ 2\overline{)50} \end{array}$$

$50 = 2 \cdot 5 \cdot 5 = 2 \cdot 5^2$

155. 37 is a prime number.

156. 83 is a prime number.

157. $$\begin{array}{r} 13 \\ 5\overline{)65} \end{array}$$

$65 = 5 \cdot 13$

158. $$\begin{array}{r} 5 \\ 2\overline{)10} \\ 2\overline{)20} \\ 2\overline{)40} \\ 2\overline{)80} \end{array}$$

$80 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 5 = 2^4 \cdot 5$

159. $$\begin{array}{r} 7 \\ 2\overline{)14} \\ 2\overline{)28} \end{array}$$

$28 = 2 \cdot 2 \cdot 7 = 2^2 \cdot 7$

160. $$\begin{array}{r} 7 \\ 7\overline{)49} \end{array}$$

$49 = 7 \cdot 7 = 7^2$

161. $$\begin{array}{r} 7 \\ 3\overline{)21} \\ 2\overline{)42} \end{array}$$

$42 = 2 \cdot 3 \cdot 7$

162. $$\begin{array}{r} 3 \\ 3\overline{)9} \\ 3\overline{)27} \\ 3\overline{)81} \end{array}$$

$81 = 3 \cdot 3 \cdot 3 \cdot 3 = 3^4$

163. $$\begin{array}{r} 17 \\ 3\overline{)51} \end{array}$$

$51 = 3 \cdot 17$

164. 89 is a prime number.

165. $$\begin{array}{r} 23 \\ 2\overline{)46} \end{array}$$

$46 = 2 \cdot 23$

166. $$\begin{array}{r} 5 \\ 3\overline{)15} \\ 2\overline{)30} \\ 2\overline{)60} \\ 2\overline{)120} \end{array}$$

$120 = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 5 = 2^3 \cdot 3 \cdot 5$

Objective E Exercises, pages 64–66

167. Strategy: To find the number of calories, multiply the number of calories in one ounce of cheese (115) by the number of ounces (4).

Solution: $4 \cdot 115 = 460$
Four ounces of cheese contain 460 calories.

168. Strategy: To find the number of total yards, multiply the number of times running the ball (2,916) by the average gain per carry (4).

Solution: $2{,}916 \cdot 4 = 11{,}664$
John Riggins gained 11,664 yd during his career.

169. Strategy: To find the amount of jet fuel used, multiply the amount of fuel used each hour (865) by the time of flight (5).

Solution: $865 \cdot 5 = 4{,}325$
The flight used 4,325 gal of jet fuel.

170. Strategy

a. To determine the perimeter of a square, substitute 16 for s in the formula below.

b. To determine the area of a square, substitute 16 for s in the formula below.

Solution

a. $P = 4 \cdot s = 4 \cdot 16 = 64$
The perimeter of the square is 64 mi.

b. $A = s^2 = (16)^2 = 256$
The area of the square is 256 mi^2.

171. Strategy

a. To determine the perimeter of a rectangle, substitute 24 for L and 15 for W in the formula below.

b. To determine the area of a rectangle, substitute 24 for L and 15 for W in the formula below.

Solution

a. $P = 2L + 2W$
$P = 2 \cdot 24 + 2 \cdot 15$
$P = 78$
The perimeter of the rectangle is 78 m.

b. $A = LW$
$A = 24 \cdot 15$
$A = 360$
The area of the rectangle is 360 m^2.

172. Strategy To find the length of fencing needed to surround a square corral, substitute 60 for s in the perimeter formula below.

Solution $P = 4 \cdot s = 4 \cdot 60 = 240$
The length of fencing needed to surround a square corral is 240 ft.

173. Strategy To find the length of fencing needed to surround a square, substitute 24 for s in the perimeter formula below.

Solution $P = 4 \cdot s = 4 \cdot 24 = 96$
The length of fencing needed to surround a square is 96 ft.

174. Strategy To find the area of the solar panel, substitute 2 for W and 3 for L in the area formula below.

Solution $A = LW = 3 \cdot 2 = 6$
The area of the solar panel is 6 ft^2.

175. Strategy To find the area of the two-car garage, substitute 24 for s in the area formula below.

Solution $A = s^2 = 24^2 = 576$
The area of the two-car garage is 576 ft^2.

176. Strategy To find the area of the patio, substitute 9 for s in the area formula below.

Solution $A = s^2 = 9^2 = 81$
The area of the patio is 9 ft^2.

177. Strategy To find the amount of fabric needed for the flag, substitute 192 for L and 308 for W in the area formula below.

Solution $A = LW = 192 \cdot 308 = 59{,}136$
The amount of fabric needed for the flag is 59,136 cm^2.

178. Strategy To find the hourly rate, divide the total earnings (5,376) by the number of hours (168) worked.

Solution $\frac{5{,}376}{168} = 32$
The consultant received $32 per hour.

179. Strategy To find the estimate of the total cost:
→Round the number of suits to hundreds and the cost of each suit to tens.
→Multiply the rounded numbers.

Solution $215 \rightarrow 200$
$83 \rightarrow 80$
$200 \cdot 80 = 16{,}000$
The total cost of the suits is approximately $16,000.

180. Strategy

a. To determine by how much their savings should grow per year from age 45 to 55:

→Find the difference between the recommended savings at 55 (280,000) and at 45 (110,000).

→Divide the difference by the number of years (55 – 45 = 10).

b. To determine by how much their savings should grow per year from age 55 to 65:

→Find the difference between the recommended savings at 65 (170,000) and at 55 (90,000).

→Divide the difference by the number of years (65 – 55 = 10).

Solution

a. $280,000 - 110,000 = 170,000$
$170,000 \div 10 = 17,000$
Their savings should grow $17,000 per year.

b. $170,000 - 90,000 = 80,000$
$80,000 \div 10 = 8,000$
Their savings should grow $8,000 per year.

181. Strategy To find the total amount paid, replace M by 285 and N by 24 in the given formula and solve for A.

Solution
$A = MN$
$A = 285 \cdot 24$
$A = 6,840$

182. Strategy To find the total amount paid, replace M by 187 and N by 36 in the given formula and solve for A.

Solution
$A = MN$
$A = 187 \cdot 36$
$A = 6,732$
The total amount paid on the loan is $6,732.

183. Strategy To find the time to drive the distance, replace d by 513 and r by 57 in the given formula and solve for t.

Solution
$t = \frac{d}{r}$
$t = \frac{513}{57}$
$t = 9$
It takes 9 h to drive 513 mi.

184. Strategy To find the time to drive the distance, replace d by 432 and r by 54 in the given formula and solve for t.

Solution
$t = \frac{d}{r}$
$t = \frac{432}{54}$
$t = 8$
It takes 8 h to drive 432 mi.

185. Strategy To find the value per share, replace C by 10,500,000 and S by 500,000 in the given formula and solve for V.

Solution
$V = \frac{C}{S}$
$V = \frac{10,500,000}{500,000}$
$V = 21$
The stock has a value of $21 per share.

186. Strategy To find the value per share, replace C by 4,500,000 and S by 250,000 in the given formula and solve for V.

Solution
$V = \frac{C}{S}$
$V = \frac{4,500,000}{250,000}$
$V = 18$
The stock has a value of $18 per share.

Critical Thinking 1.3, page 70

187. There are 7 days in one week. There are 52 weeks in one year.
$7 \cdot 52 = 364$ days.
There are 364 days in 52 weeks.
There are 365 days in one year (366 days in a leap year).
"52 weeks in one year" is an approximation.

188. The largest possible number that can be written using the digits 1, 3, 8, 2, and 7 is 87,321.
87,321 is not divisible by 4.
The next largest possible number that can be written using these digits is 87,312.
87,312 is divisible by 4.
87,312 is the largest possible number that can be written using the digits 1, 3, 8, 2, 7 and that is divisible by 4.

189. We need to find the smallest three-digit multiple of 6 that is a palindromic number.
The smallest three digit palindromic number is 101; the next is 121; the next is 131.
Any three-digit palindromic number that has a 1 in the hundreds' place must have a 1 in the ones' place.
No number that has a 1 in the one's place is divisible by 6.
The smallest three-digit palindromic number with a 2 in the hundreds' place is 202, which is not divisible by 6.
The next smallest is 212, which is not divisible by 6.
222 is the smallest three-digit multiple of 6 that is a palindromic number.

190. **a.** If 0 is substituted for a in $a \cdot 0 = 0$, the result is a true equation.
Substituting any other whole number for a in $a \cdot 0 = a$ will result in a false equation.
The statement is sometimes true.

b. If 1 is substituted for a in $a \cdot 1 = 1$, the result is a true equation.
Substituting any other whole number for a in $a \cdot 1 = 1$ will result in a false equation.
The statement is sometimes true.

Section 1.4

Objective A Exercises, page 75

1. $x + 9 = 23$
$x + 9 - 9 = 23 - 9$
$x + 0 = 14$
$x = 14$
The solution is 14.

2. $y + 17 = 42$
$y + 17 - 17 = 42 - 17$
$y + 0 = 25$
$y = 25$
The solution is 25.

3. $8 + b = 33$
$8 - 8 + b = 33 - 8$
$0 + b = 25$
$b = 25$
The solution is 25.

4. $15 + n = 54$
$15 - 15 + n = 54 - 15$
$0 + n = 39$
$n = 39$
The solution is 39.

5. $3m = 15$
$\frac{3m}{3} = \frac{15}{3}$
$1m = 5$
$m = 5$
The solution is 5.

6. $8z = 32$
$\frac{8z}{8} = \frac{32}{8}$
$1z = 4$
$z = 4$
The solution is 4.

7. $52 = 4c$
$\frac{52}{4} = \frac{4c}{4}$
$13 = 1c$
$13 = c$
The solution is 13.

8. $60 = 5d$
$\frac{60}{5} = \frac{5d}{5}$
$12 = 1d$
$12 = d$
The solution is 12.

9. $16 = w + 9$
$16 - 9 = w + 9 - 9$
$7 = w + 0$
$7 = w$
The solution is 7.

10. $72 = t + 44$
$72 - 44 = t + 44 - 44$
$28 = t + 0$
$28 = t$
The solution is 28.

11. $28 = 19 + p$
$28 - 19 = 19 - 19 + p$
$9 = 0 + p$
$9 = p$
The solution is 9.

12. $33 = 18 + x$
$33 - 18 = 18 - 18 + x$
$15 = 0 + x$
$15 = x$
The solution is 15.

13. $10y = 80$
$\frac{10y}{10} = \frac{80}{10}$
$1y = 8$
$y = 8$
The solution is 8.

14. $12n = 60$
$\frac{12n}{12} = \frac{60}{12}$
$1n = 5$
$n = 5$
The solution is 5.

15. $41 = 41d$
$\frac{41}{41} = \frac{41d}{41}$
$1 = 1d$
$1 = d$
The solution is 1.

16. $93 = 93m$
$\frac{93}{93} = \frac{93m}{93}$
$1 = 1m$
$1 = m$
The solution is 1.

17. $b + 7 = 7$
$b + 7 - 7 = 7 - 7$
$b + 0 = 0$
$b = 0$
The solution is 0.

18. $q + 23 = 23$
$q + 23 - 23 = 23 - 23$
$q + 0 = 0$
$q = 0$
The solution is 0.

19. $15 + t = 91$
$15 - 15 + t = 91 - 15$
$0 + t = 76$
$t = 76$
The solution is 76.

20. $79 + w = 88$
$79 - 79 + w = 88 - 79$
$0 + w = 9$
$w = 9$
The solution is 9.

21. $4 + a = 25$
$4 - 4 + a = 25 - 4$
$0 + a = 21$
$a = 21$
The solution is 21.

22. $33 = 12 + v$
$33 - 12 = 12 - 12 + w$
$21 = 0 + w$
$w = 21$
The solution is 21.

23. $c + 17 = 50$
$c + 17 - 17 = 50 - 17$
$c + 0 = 33$
$c = 33$
The solution is 33.

24. $100 = z + 41$
$100 - 41 = z + 41 - 41$
$59 = z + 0$
$z = 59$
The solution is 59.

Objective B Exercises, page 75–76

25. The unknown number: n

sixteen added to a number	is equal to	forty

$n + 16 = 40$
$n + 16 - 16 = 40 - 16$
$n = 24$
The number is 24.

26. The unknown number: n

the sum of eleven and a number	equals	fifty-two

$11 + n = 52$
$11 - 11 + n = 52 - 11$
$n = 41$
The number is 41.

27. The unknown number: n

five times a number	is	thirty

$5n = 30$
$\frac{5n}{5} = \frac{30}{5}$
$n = 6$
The number is 6.

28. The unknown number: n

the product of ten and a number	is equal to	two hundred

$10n = 200$
$\frac{10n}{10} = \frac{200}{10}$
$n = 20$
The number is 20.

29. The unknown number: n

fifteen	is	three more than a number

$15 = n + 3$
$15 - 3 = n + 3 - 3$
$12 = n$
The number is 12.

30. The unknown number: n

One thousand	represents	three hundred fifty plus a number

$1{,}000 = 350 + n$
$1{,}000 - 350 = 350 - 350 + n$
$650 = n$
The number is 650.

31. The unknown number: n

a number increased by fourteen	equals	seventy-two

$n + 14 = 72$
$n + 14 - 14 = 72 - 14$
$n = 58$
The number is 58.

32. The unknown number: n

a number multiplied by twenty	equals	four hundred

$20n = 400$
$\frac{20n}{20} = \frac{400}{20}$
$n = 20$
The number is 20.

33. Strategy To find the width of the rectangle, write and solve an equation using w to represent the width.

Solution

the width of a rectangle	is	5 in. more than the length

$17 = w + 5$
$17 - 5 = w + 5 - 5$
$12 = w$
The width of the rectangle is 12 in.

34. Strategy To find the average daily low temperature in December, write and solve an equation using x to represent the average daily low temperature in December.

Solution

the average daily low temperature in June	is	eight times the average daily low temperature in December

$48 = 8x$
$\frac{48}{8} = \frac{8x}{8}$
$6 = x$
The average daily low temperature in December is 6°.

35. Strategy To find the distance from Forth Worth to Austin, write and solve an equation using x to represent the distance from Forth Worth to Austin.

Solution

the distance from Galveston to Austin	is	22 miles more than the distance from Forth Worth to Austin

$212 = x + 22$
$212 - 22 = x + 22 - 22$
$190 = x$
The distance from Forth Worth to Austin is 190 mi.

36. Strategy To find the distance from San Antonio to Austin, write and solve an equation using x to represent the distance from San Antonio to Austin.

Solution

the distance from Houston to Austin	is	twice the distance from San Antonio to Austin

$160 = 2x$
$\frac{160}{2} = \frac{2x}{2}$
$80 = x$
The distance from San Antonio to Austin is 80 mi.

37. Strategy To find the number of payments, replace A by 13,968 and M by 582 in the given formula and solve for N.

Solution
$A = MN$
$13{,}968 = 582N$
$\frac{13{,}968}{582} = \frac{582N}{582}$
$24 = N$
The number of payments is 24.

38. Strategy To find the number of payments, replace A by 17,460 and M by 485 in the given formula and solve for N.

Solution
$A = MN$
$17{,}460 = 485N$
$\frac{17{,}460}{485} = \frac{485N}{485}$
$36 = N$
The number of payments is 36.

39. Strategy To find the time, replace d by 1,120 and r by 140 in the given formula and solve for t.

Solution
$d = rt$
$1{,}120 = 140t$
$\frac{1{,}120}{140} = \frac{140t}{140}$
$8 = t$
It would take 8 h to travel 1,120 mi at a speed of 140 mph.

40. Strategy To find the time, replace d by 825 and r by 165 in the given formula and solve for t.

Solution
$d = rt$
$825 = 165t$
$\frac{825}{165} = \frac{165t}{165}$
$5 = t$
It would take 5 h to travel 825 mi at a speed of 165 mph.

Critical Thinking 1.4, page 76

41. Answers will vary. For example, (a) $5x = 0$, (b) $8x = 8$.

Section 1.5

Objective A Exercises, pages 79–80

3. $8 \div 4 + 2 = 2 + 2$
$= 4$

4. $12 - 9 \div 3 = 12 - 3$
$= 9$

5. $6 \cdot 4 + 5 = 24 + 5$
$= 29$

6. $5 \cdot 7 + 3 = 35 + 3$
$= 38$

7. $4^2 - 3 = 16 - 3$
$= 13$

8. $6^2 - 14 = 36 - 14$
$= 22$

9. $5 \cdot (6 - 3) + 4 = 5 \cdot 3 + 4$
$= 15 + 4$
$= 19$

10. $8 + (6 + 2) \div 4 = 8 + 8 \div 4$
$= 8 + 2$
$= 10$

11. $9 + (7 + 5) \div 6 = 9 + 12 \div 6$
$= 9 + 2$
$= 11$

12. $14 \cdot (3 + 2) \div 10 = 14 \cdot 5 \div 10$
$= 70 \div 10$
$= 7$

13. $13 \cdot (1 + 5) \div 13 = 13 \cdot 6 \div 13$
$= 78 \div 13$
$= 6$

14. $14 - 2^3 + 9 = 14 - 8 + 9$
$= 6 + 9$
$= 15$

15. $6 \cdot 3^2 + 7 = 6 \cdot 9 + 7$
$= 54 + 7$
$= 61$

16. $18 + 5 \cdot 3^2 = 18 + 5 \cdot 9$
$= 18 + 45$
$= 63$

17. $14+5\cdot 2^3=14+5\cdot 8$
$=14+40$
$=54$

18. $20+(9-4)\cdot 2=20+5\cdot 2$
$=20+10$
$=30$

19. $10+(8-5)\cdot 3=10+3\cdot 3$
$=10+9$
$=19$

20. $3^2+5\cdot(6-2)=3^2+5\cdot 4$
$=9+5\cdot 4$
$=9+20$
$=29$

21. $2^3+4(10-6)=2^3+4\cdot 4$
$=8+4\cdot 4$
$=8+16$
$=24$

22. $3^2\cdot 2^2+3\cdot 2=9\cdot 4+3\cdot 2$
$=36+3\cdot 2$
$=36+6$
$=42$

23. $6(7)+4^2\cdot 3^2=6(7)+16\cdot 9$
$=42+16\cdot 9$
$=42+144$
$=186$

24. $14-2(6)=14-12$
$=2$

25. $18+3(7)=18+21$
$=39$

26. $2(9-2)+5=2(7)+5$
$=14+5$
$=19$

27. $6(8-3)-12=6(5)-12$
$=30-12$
$=18$

28. $15-(7-1)\div 3=15-6\div 3$
$=15-2$
$=13$

29. $16-(13-5)\div 4=16-8\div 4$
$=16-2$
$=14$

30. $11+2-3\cdot 4\div 3=11+2-12\div 3$
$=11+2-4$
$=13-4$
$=9$

31. $17+1-8\cdot 2\div 4=17+1-16\div 4$
$=17+1-4$
$=18-4$
$=14$

32. $3(5+3)\div 8=3\cdot 8\div 8$
$=24\div 8$
$=3$

33. $x-2y$
$8-2\cdot 3=8-6$
$=2$

34. $x+6y$
$5+6\cdot 4=5+24$
$=29$

35. x^2+3y
$6^2+3\cdot 7=36+3\cdot 7$
$=36+21$
$=57$

36. $3x^2+y$
$3\cdot 2^2+9=3\cdot 4+9$
$=12+9$
$=21$

37. $x^2+y\div x$
$2^2+8\div 2=4+8\div 2$
$=4+4$
$=8$

38. $x+y^2\div x$
$4+8^2\div 4=4+64\div 4$
$=4+16$
$=20$

39. $4x+(x-y)^2$
$4\cdot 8+(8-2)^2=4\cdot 8+6^2$
$=4\cdot 8+36$
$=32+36$
$=68$

40. $(x+y)^2-2y$

$(3+6)^2-2\cdot 6=9^2-2\cdot 6$
$=81-2\cdot 6$
$=81-12$
$=69$

41. $x^2+3(x-y)+z^2$

$2^2+3(2-1)+3^2=2^2+3\cdot 1+3^2$
$=4+3\cdot 1+9$
$=4+3+9$
$=7+9$
$=16$

42. $x^2+4(x-y)\div z^2$

$8^2+4(8-6)\div 2^2=8^2+4\cdot 2\div 2^2$
$=64+4\cdot 2\div 4$
$=64+8\div 4$
$=64+2$
$=66$

Critical Thinking 1.5, page 80

43. $15+(8-3)(2^4)=15+(8-3)(16)$
$=15+(5)(16)=15+80=95$
We are looking for the smallest prime number greater than 95.
96 is not prime (for example, it is divisible by 2).
97 is prime.
97 is the smallest prime number greater than $15+(8-3)(2^4)$.

44. Answers will vary.
For example, $3+5\cdot 4$ could be used to determine if a calculator uses the Order of Operations Agreement.
Using the Order of Operations Agreement, the expression is equal to 23.
If a calculator does not use the Order of Operations Agreement, the result is 32.

Chapter Review Exercises, pages 85–86

1.

2. $10^4=10{,}000$

3.
$$\begin{array}{r} 4{,}207 \\ -1{,}624 \\ \hline 2{,}583 \end{array}$$

4. $3\cdot 3\cdot 5\cdot 5\cdot 5\cdot 5=3^2\cdot 5^4$

5.
$$\begin{array}{r} 319 \\ 358 \\ +712 \\ \hline 1{,}389 \end{array}$$

6. 38,729 Given place value
$2<5$
38,729 rounded to the nearest hundred is 38,700

7. $247>163$

8. 32,509

9. $2xy$
$2\cdot 50\cdot 7=100\cdot 7$
$=700$

10.
$$\begin{array}{r} 2{,}607 \\ 6\overline{)15{,}642} \\ \underline{-12} \\ 36 \\ \underline{-36} \\ 4 \\ \underline{-0} \\ 42 \\ \underline{-42} \\ 0 \end{array}$$

11.
$$\begin{array}{r} 6{,}407 \\ -2{,}359 \\ \hline 4{,}048 \end{array}$$

12.
$$\begin{array}{rcr} 482 & \rightarrow & 500 \\ 319 & \rightarrow & 300 \\ 570 & \rightarrow & 600 \\ 146 & \rightarrow & +100 \\ & & \overline{1{,}500} \end{array}$$

13. $50\div 1=50$
$50\div 2=25$
$50\div 5=10$
$50\div 10=5$
The factors of 50 are 1, 2, 5, 10, 25, and 50.

14.
$$\begin{array}{l|l} 24-y=17 & \\ \hline 24-7 & 17 \end{array}$$
$17=17$
Yes, 7 is a solution of the equation.

15. $16+4(7-5)^2 \div 8 = 16+4\cdot 2^2 \div 8$
$= 16 + 4 \cdot 4 \div 8$
$= 16 + 16 \div 8$
$= 16 + 2$
$= 18$

16. The Commutative Property of Addition

17. Four million nine hundred twenty-seven thousand thirty-six

18. $x^3 y^2$
$3^3 \cdot 5^2 = (3\cdot 3\cdot 3)\cdot(5\cdot 5)$
$= 27 \cdot 25$
$= 675$

19. Strategy

a. To determine by many times more PG-13 films were released than NC-17 films:
→Find the number of PG-13 films (112) and the number of NC-17 films (7) from the pie chart.
→Divide the number of PG-13 films by the number of NC-17 films.

b. To determine by many times more R rated films were released than NC-17 films:
→Find the number of R rated films (427) and the number of NC-17 films (7) from the pie chart.
→Divide the number of R rated films by the number of NC-17 films.

Solution

a. $\dfrac{112}{7} = 16$
There were 16 times more PG-13 films released than NC-17 films.

b. $\dfrac{427}{7} = 61$
There were 61 times more R rated films released than NC-17 films.

20.
$$\begin{array}{r} 67 \text{ r } 70 \\ 92\overline{)\ 6,234} \\ \underline{-552} \\ 714 \\ \underline{-644} \\ 70 \end{array}$$

21.
$$\begin{array}{r} 659 \\ \underline{\times\ 4} \\ 2,636 \end{array}$$

22. $x - y$
$270 - 133 = 137$

23.
$$\begin{array}{r} 5 \\ 3\overline{)15} \\ 3\overline{)45} \\ 2\overline{)90} \end{array}$$
$90 = 2\cdot 3\cdot 3\cdot 5 = 2\cdot 3^2\cdot 5$

24. $\dfrac{x}{y}$
$\dfrac{480}{6} = 80$

25. $1 \cdot 82 = 82$

26. $36 = 4x$
$\dfrac{36}{4} = \dfrac{4x}{4}$
$9 = x$
The solution is 9.

27. $x + y$
$683 + 249 = 932$

28.
$$\begin{array}{r} 18 \\ \underline{\times\ 24} \\ 72 \\ \underline{36} \\ 432 \end{array}$$

29. $(a+b)^2 - 2c$
$(5+3)^2 - 2\cdot 4 = 8^2 - 2\cdot 4$
$= 64 - 2 \cdot 4$
$= 64 - 8$
$= 5$

30. Strategy: To find the person with the greater number of rebounds, compare the numbers 17,440 and 16,279.

Solution: $17,440 > 16,279$
Kareem Abdul-Jabbar had more rebounds.

31. Strategy To find the total cost, multiply the number of square feet of floor space (2,800) by the cost per square feet (65).

Solution $2{,}800 \cdot 65 = 182{,}000$
The total cost of the contractor's work will be $182,000.

32. Strategy
a. To find the perimeter of the rectangle, substitute 25 for L and 12 for W in the formula below.

b. To find the area of the rectangle, substitute 25 for L and 12 for W in the formula below.

Solution
a. $P = 2L + 2W$
$P = 2 \cdot 25 + 2 \cdot 12$
$P = 50 + 24$
$P = 74$
The perimeter is 74 m.

b. $A = LW$
$A = 25 \cdot 12$
$A = 300$
The area is 300 m^2.

33. Strategy To determine between which decade the number of students enrolled in college increased the most, and the amount of increase, find the amount of increase for each decade. Then compare the numbers.

Solution 1960 to 1970: $8{,}581{,}000 - 3{,}789{,}000 = 4{,}792{,}000$
1970 to 1980: $12{,}097{,}000 - 8{,}581{,}000 = 3{,}516{,}000$
1980 to 1990: $13{,}819{,}000 - 12{,}097{,}000 = 1{,}722{,}000$
1990 to 2000: $14{,}889{,}000 - 13{,}819{,}000 = 1{,}070{,}000$
$4{,}792{,}000 > 3{,}516{,}000 > 1{,}722{,}000 > 1{,}070{,}000$

a. The number of students enrolled in college increased the most from 1960 to 1970.

b. The amount of increase was 4,792,000 people.

34. Strategy To find the distance traveled, substitute 3 for t and 14 for r in the given formula and solve for d.

Solution $d = rt$
$d = 14 \cdot 3$
$d = 42$
The cyclist traveled 42 mi.

35. Strategy To find the markup, substitute 2,224 for S and 1,775 for C in the given formula and solve for M.

Solution $M = S - C$
$M = 2{,}224 - 1{,}775$
$M = 449$
The markup on the word processor is $449.

Chapter Test, pages 87–88

1. $3{,}297 \cdot 100 = 329{,}700$

2. $2 \cdot 2 \cdot 2 \cdot 2 \cdot 10 \cdot 10 \cdot 10 = 16{,}000$

3. $$\begin{array}{r} 4{,}902 \\ -873 \\ \hline 4{,}029 \end{array}$$

4. $x \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y = x^4y^3$

5. $23 = p + 16$
$23 - 16 = p + 16 - 16$
$7 = p$
Yes

6. $\underset{\llcorner 6 > 5}{2{,}\overset{\ulcorner \text{Given place value}}{9}61}$
2,961 rounded to the nearest hundred is 3,000.

7. $7{,}177 < 7{,}717$

8. 8,490

9. three hundred eighty-two thousand nine hundred four

10. $$\begin{array}{rcr} 392 & \rightarrow & 400 \\ 477 & \rightarrow & 500 \\ 519 & \rightarrow & 500 \\ +648 & \rightarrow & 600 \\ \hline 2{,}036 & & 2{,}000 \end{array}$$

11. $$\begin{array}{r} 1{,}376 \\ \times \ 8 \\ \hline 11{,}008 \end{array}$$

12. $36{,}479 \rightarrow 40{,}000$
$50 \rightarrow 60$
$40{,}000 \cdot 60 = 2{,}400{,}000$
$36{,}479 \cdot 58 = 2{,}115{,}782$

13. $92 \div 1 = 92$
$92 \div 2 = 46$
$92 \div 4 = 23$
$92 \div 23 = 4$
The factors of 92 are 1, 2, 4, 23, 46, 92.

14. $$\begin{array}{r} 5 \\ 3\overline{)15} \\ 2\overline{)30} \\ 2\overline{)60} \\ 2\overline{)120} \\ 2\overline{)240} \end{array}$$
$240 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 5 = 2^4 \cdot 3 \cdot 5$

15. $x - y$
$39{,}241 - 8{,}375$
$= 30{,}866$

16. The Commutative Property of Addition

17. $\dfrac{x}{y}$
$\dfrac{3{,}588}{4}$
$= 897$

18. $27 - (12 - 3) \div 9$
$= 27 - 9 \div 9$
$= 27 - 1$
$= 26$

19. $40{,}478 - 24{,}804$
$= \$15{,}674$

20. $60 = 17 + d$
$60 - 17 = 17 + d - 17$
$51 = d$
The solution is 51.

21. $176 = 4t$
$\dfrac{176}{4} = \dfrac{4t}{4}$
$t = 44$
The solution is 44.

22. $5x + (x - y)^2$
$5 \cdot 8 + (8 - 4)^2$
$= 40 + 4^2$
$= 40 + 16$
$= 56$
The solution is 56.

23. 7

24. $12 + x = 90$
$12 + x - 12 = 90 - 12$
$x = 78$
The number is 78.

25. $6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 720$

26. Strategy First, to find the total cost of the computer system, add the prices of the components. Then, to find the balance of the checking account, subtract the total cost of the computer system from \$2,276.

Solution $850 + 270 + 175 + 425 = 1720$
$2{,}276 - 720 = 556$
The balance is \$556.

27. Strategy
a. To find the perimeter of the square, substitute 24 for s in the formula below.

b. To find the area of the square, substitute 24 for s in the formula below.

Solution
a. $P = 4s$
$P = 4 \cdot 24$
$P = 96$
The perimeter is 96 cm.

b. $A = s^2$
$A = (24)^2$
$A = 576$
The area is 576 cm^2.

28. Strategy To find the bookkeeper's take home pay, subtract the sum of his deductions, taxes (429), retirement (136), and insurance (54), from the total salary (2,845).

Solution $2{,}845 - (429 + 136 + 54)$
$= 2{,}845 - 619$
$= 2{,}226$
The bookkeeper's take home pay is \$2,226.

29. Strategy
a. To determine between which two years the amount of household wealth increased the most, for year there was an increase, find the increase. Then compare the numbers.

b. The amount of increase is the largest amount.

Solution
1995 to 1996 = 1,586 – 1,265 = 321
1996 to 1997 = 2,057 – 1,586 = 471
1997 to 1998 = 2,501 – 2,057 = 444
1998 to 1999 = 3,104 – 2,501 = 603
$603 > 471 > 444 > 321$
a. The amount of household wealth in mutual funds increased the most from 1998 to 1999.

b. The amount of increase was \$603 billion.

30. Strategy To find the commission earned, substitute 2 for U and 480 for R in the given formula and solve for C.

Solution $C = U \cdot R$
$= 2 \cdot 480$
$= 960$
The commission earned is \$960.

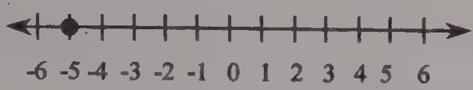
31. Strategy To find the value per share of the fund, substitute 4,400,000 for C and 500,000 for S in the given formula and solve for V.

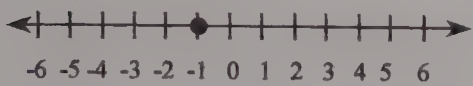
Solution $V = \dfrac{C}{S} = \dfrac{5{,}5000{,}000}{500{,}000} = 11$
The value per share is \$11.

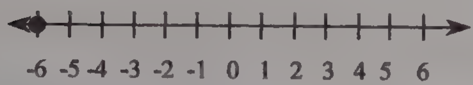
Chapter 2

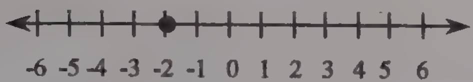
Section 2.1

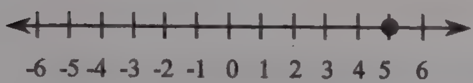
Objective A Exercises, pages 97–98

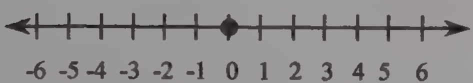
1. 

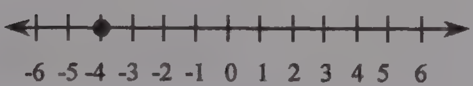
2. 

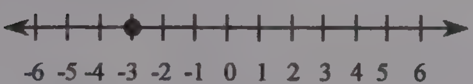
3. 

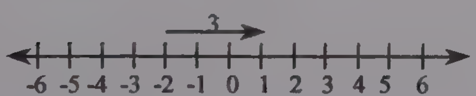
4. 

5. 

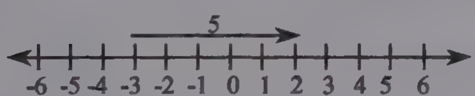
6. 

7. 

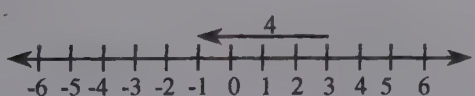
8. 

9. 

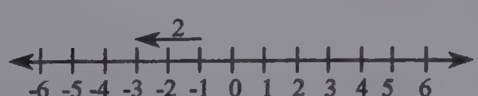
   1 is 3 units to the right of –2.

10. 

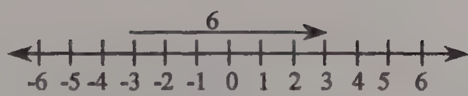
    2 is 5 units to the right of –3.

11. 

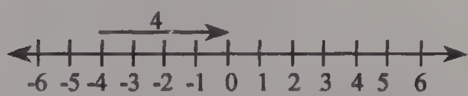
    –1 is 4 units to the left of 3.

12. 

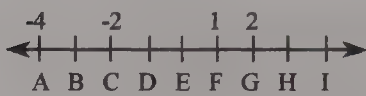
    –3 is 2 units to the left of –1.

13. 

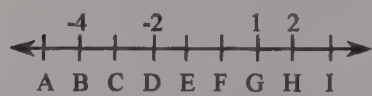
    3 is 6 units to the right of –3.

14. 

    0 is 4 units to the right of –4.

15. 

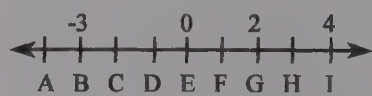
    A is –4, and C is –2.

16. 

    B is –4, and D is –2.

17. 

    A is –7, and D is –4.

18. 

    B is –3, and E is 0.

19. $-2 > -5$
20. $-6 < -1$
21. $3 > -7$
22. $-11 < -8$
23. $-42 < 27$
24. $21 > -34$
25. $53 > -46$
26. $-27 > -39$
27. $-51 < -20$
28. $-136 < 0$
29. $-131 < 101$
30. $127 > -150$

31. $-7, -2, 0, 3$

32. $-4, -1, 6, 8$

33. $-5, -3, 1, 4$

34. $-8, -6, 2, 7$

35. $-4, 0, 5, 9$

36. $-12, -9, 6, 8$

37. $-10, -7, -5, 4, 12$

38. $-8, -6, -1, 7, 11$

39. $-11, -7, -2, 5, 10$

Objective B Exercises, pages 98–99

40. -22

41. -45

42. 31

43. 88

44. $-c$

45. $-n$

46. w

47. d

48. the opposite of negative eleven

49. the opposite of negative thirteen

50. the opposite of negative d

51. the opposite of negative p

52. negative two plus negative five

53. five plus negative ten

54. six minus negative seven

55. negative fourteen minus negative three

56. nine minus twelve

57. negative thirteen minus eight

58. negative a minus b

59. m plus the opposite of n

60. $-(-5) = 5$

61. $-(-7) = 7$

62. $-(-38) = 38$

63. $-(-61) = 61$

64. $-(29) = -29$

65. $-(46) = -46$

66. $-(-52) = 52$

67. $-(-73) = 73$

68. $-(-m) = m$

69. $-(-z) = z$

70. $-(b) = -b$

71. $-(p) = -p$

Objective C Exercises, pages 99–100

72. $|4| = 4$

73. $|-4| = 4$

74. $|-7| = 7$

75. $|9| = 9$

76. $|-1| = 1$

77. $|-11| = 11$

78. $|10| = 10$

79. $|-12| = 12$

80. $|-15| = 15$

81. $|-23| = 23$

82. $-|33| = -33$

83. $-|27| = -27$

84. $|32| = 32$

85. $|25| = 25$

86. $-|-36| = -36$

87. $-|-41| = -41$

88. $-|-81| = -81$

89. $-|-93| = -93$

90. $|x|$
$|7| = 7$

91. $|x|$
$|-10| = 10$

92. $|-x|$
$|-2| = 2$

93. $|-x|$
$|-8| = 8$

94. $|-y|$
$|-(-3)| = |3| = 3$

95. $|-y|$
$|-(-6)| = |6| = 6$

96. $|7| = 7, |-9| = 9$
$7 < 9$
$|7| < |-9|$

97. $|-12| = 12, |8| = 8$
$12 > 8$
$|-12| > |8|$

98. $|-5| = 5, |-2| = 2$
$5 > 2$
$|-5| > |-2|$

99. $|6| = 6, |13| = 13$
$6 < 13$
$|6| < |13|$

100. $|-8| = 8, |3| = 3$
$8 > 3$
$|-8| > |3|$

101. $|-1| = 1, |-17| = 17$
$1 < 17$
$|-1| < |-17|$

102. $|-14| = 14, |14| = 14$
$14 = 4$
$|-14| = |14|$

103. $x = x$
$|x| = |-x|$

104. $|-8| = 8, -(-3) = 3, |2| = 2, -|-5| = -5$
$-|-5|, |2|, -(-3), |-8|$

105. $-|6| = -6, -(4) = -4, |-7| = 7, -(-9) = 9$
$-|6|, -(4), |-7|, -(-9)$

106. $-(-1) = 1, |-6| = 6, |0| = 0, -|3| = -3$
$-|3|, |0|, -(-1), |-6|$

107. $-|-7| = -7, -9 = -9, -(5) = -5, |4| = 4$
$-9, -|-7|, -(5), |4|$

108. $-|2| = -2, -(-8) = 8, 6 = 6, |1| = 1,$
$-7 = -7$
$-7, -|2|, |1|, 6, -(-8)$

109. $-(-3) = 3, -|-8| = -8, |5| = 5,$
$-|10| = -10, -(-2) = 2$
$-|10|, -|-8|, -(-2), -(-3), |5|$

110. The absolute value of a number is the distance from zero to the number on the number line. If $|a| = 7$, then a must be a number that is 7 units from 0 on the number line. Therefore, a is 7 or –7.

111. The absolute value of a number is the distance from zero to the number on the number line. If $|y| = 11$, then y must be a number that is 11 units from 0 on the number line. Therefore, y is 11 or –11.

112. x must be less than 5 and greater than –5.
–4, –3, –2, –1, 0, 1, 2, 3, 4

113. x must be less than 7 and greater than –7.
–6, –5, –4, –3, –2, –1, 0, 1, 2, 3, 4, 5, 6

Objective D Exercises, pages 100–102

114. Strategy — To find the wind chill factor, use the given table.

Solution — Find the number where the column with 5 and the row with 15 cross. Read the number –25.
The wind chill factor is –25°F.

115. Strategy To find the wind chill factor, use the given table.

Solution Find the number where the column with 10 and the row with 20 cross. Read the number –24.
The wind chill factor is –24°F.

116. Strategy To find the cooling power, use the given table.

Solution Find the number where the column with –10 and the row with 5 cross. Read the number –15.
The cooling power is –15°F.

117. Strategy To find the cooling power, use the given table.

Solution Find the number where the column with –15 and the row with 10 cross. Read the number –40.
The cooling power is –40°F.

118. Strategy To find which situation feels colder:
→From the given table, find the wind chill factor with a temperature of 0°F with a 15-mph wind and the wind chill factor with a temperature of 10°F with a 25-mph wind.
→Compare the wind chill factors.

Solution The wind chill factor with a temperature of 0°F and 15-mph wind is –31°F.
The wind chill factor with a temperature of 10°F and 25-mph wind is –29°F.
$-31 < -29$
0°F with a 15-mph wind feels colder.

119. Strategy To find the situation which feels colder:
→From the given table, find the wind chill factor with a temperature of –30°F with a 5-mph wind and the wind chill factor with a temperature of –20°F with a 10-mph wind.
→Compare the wind chill factors.

Solution The wind chill factor with a temperature of –30°F and 5-mph wind is –36°F.
The wind chill factor with a temperature of –20°F and 10-mph wind is –46°F.
$-36 > -46$
–20°F with a 10-mph wind feels colder.

120. Strategy To determine which number is closer to blast off, compare the absolute values of the numbers –12 and –17. The smaller number represents the number closer to blast off.

Solution $|-12| = 12, |-17| = 17$
$12 < 17$
–12 min is closer to blast off.

121. Strategy

a. To find the earnings per share in 2000, read the number in the bar graph below the bar corresponding to 2000.

b. To find the earnings per share in 2002, read the number in the bar graph below the bar corresponding to 2002.

Solution

a. The earnings per share for 2000 were –27¢.

b. The earnings per share for 2002 were –40¢.

122. Strategy To find the year in which Mycogen had the greatest loss, use the bar graph to find the year in which earnings per share were lowest.

Solution The lowest recorded earnings per share were –83¢.
Earnings per share were –83¢ in 2004.
Mycogen had the greatest loss in 2004.

123. Strategy To find a year in which Mycogen had a profit, use the bar graph to find a year in which earnings per share were positive.

Solution The only recorded positive earnings per share were 11¢. Earnings per share were 11¢ in 1994.
Mycogen did earn a profit during the years shown.
Mycogen earned a profit in 2003.

124. Strategy To determine in which year, 1999 or 2001, earnings per share were lower, compare the earnings per share in 1999 (–18) and 2001 (–47).

Solution $-47 < -18$
Earnings per share were lower in 2001 than in 1999.

125. Strategy To determine which stock showed the least net change, compare the absolute values of the numbers –1 and –2. The smaller number represents the least net change.

Solution $|-1| = 1, |-2| = 2$
$1 < 2$
Stock B showed the least net change.

126. Strategy To determine which quarter had the greater loss, compare the absolute values of the numbers –12,575 and –11,350. The larger number corresponds to the quarter with the greater loss.

Solution $|-12,575| = 12,575,$
$|-11,350| = 11,350$
$12,575 > 11,350$
The loss was greater during the first quarter.

127. Strategy To determine which quarter has the greater loss, compare the absolute values of the numbers –26,800, and –24,900. The larger number corresponds to the quarter with the greater loss.

Solution $|-26,800| = 26,800$
$|-24,900| = 24,900$
$26,800 > 24,900$
The loss was greater during the third quarter.

Critical Thinking 2.1, page 102

128. If A is a point on the number line halfway between –9 and 3, then A is the graph of –3.
B is a point halfway between A and the graph of 1 on the number line.
Therefore, B is a point halfway between –3 and 1.
B is the graph of –1.

129. **a.** Two numbers that are 4 units from 2 on the number line are –2 and 6.

b. Two numbers that are 5 units from 3 on the number line are –2 and 8.

130. **a.** If $n = -1$, then $-n = -(-1) = 1$, which is not a negative number.
If $n = 1$, then $-n = -(-1) = -1$, which is a negative number.
The statement is sometimes true.

b. The opposite of the number 0 is 0, and 0 and 0 are not different numbers.
The opposite of 1 is –1, and 1 and –1 are different numbers.
The statement is sometimes true.

c. Substitute –2 for x: $|-2| = 2$; so $|-2| > -2$.
Substitute 2 for x: $|2| = 2$; $|2|$ is not greater than 2.
The statement is sometimes true.

d. Substitute 2 for x: $|2| = 2$; so $|2| > -2$.
Substitute –2 for x: $|-2| = 2; -(-2) = 2; |-2|$ is not greater than $-(-2)$.
The statement is sometimes true.

e. If n is any negative number, then $-n$ is the opposite of the negative number, which is a positive number.
The statement is always true.

f. If n is any positive number, then $-n$ is the opposite of the positive number, which is a negative number.
The statement is always true.

131. **a.** Enter the number 9. Press the +/– key.

b. Enter the number 20. Press the +/– key.

c. Enter the number 148. Press the +/– key.

d. Enter the number 573. Press the +/– key.

132. Since z is an integer, and $|z| < 15$, z must be less than 15 or greater than –15: –14, –13, –12, –11, –10, –9, –8, –7, –6, –5, –4, –3, –2, –1, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14.
Of these values of z, the numbers for which $|z| > 10$ are: –14, –13, –12, –11, 11, 12, 13, 14.

133. Since x is an integer and $|x| < 10$, x must be less than 10 and greater than –10: –9, –8, –7, –6, –5, –4, –3, –2, –1, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.
Of these values of x, the numbers for which $|x| > 6$ are: –9, –8, –7, 7, 8, 9.

Section 2.2

Objective A Exercises, pages 111–113

3. $-3 + (-8) = -11$

4. $-6 + (-9) = -15$

5. $-8 + 3 = -5$

6. $-7 + 2 = -5$

7. $-5 + 13 = 8$

8. $-4 + 11 = 7$

9. $6 + (-10) = -4$

10. $8 + (-12) = -4$

11. $3 + (-5) = -2$

12. $6 + (-7) = -1$

13. $-4 + (-5) = -9$

14. $-12 + (-12) = -24$

15. $-6 + 7 = 1$

16. $-9 + 8 = -1$

17. $(-5) + (-10) = -15$

18. $(-3) + (-17) = -20$

19. $-7 + 7 = 0$

20. $-11 + 11 = 0$

21. $(-15) + (-6) = -21$

22. $(-18) + (-3) = -21$

23. $0 + (-14) = -14$

24. $-19 + 0 = -19$

25. $73 + (-54) = 19$

26. $-89 + 62 = -27$

27. $2 + (-3) + (-4) = -1 + (-4)$
$= -5$

28. $7 + (-2) + (-8) = 5 + (-8)$
$= -3$

29. $-3 + (-12) + (-15) = -15 + (-15)$
$= -30$

30. $9 + (-6) + (-16) = 3 + (-16)$
$= -13$

31. $-17 + (-3) + 29 = -20 + 29$
$= 9$

32. $13 + 62 + (-38) = 75 + (-38)$
$= 37$

33. $11 + (-22) + 4 + (-5)$
$= -11 + 4 + (-5)$
$= -7 + (-5)$
$= -12$

34. $-14 + (-3) + 7 + (-6)$
$= -17 + 7 + (-6)$
$= -10 + (-6)$
$= -16$

35. $-22 + 10 + 2 + (-18)$
$= -12 + 2 + (-18)$
$= -10 + (-18)$
$= -28$

36. $-6 + (-8) + 13 + (-4)$
$= -14 + 13 + (-4)$
$= -1 + (-4)$
$= -5$

37. $-25 + (-31) + 24 + 19$
$= -56 + 24 + 19$
$= -32 + 19$
$= -13$

38. $10 + (-14) + (-21) + 8$
$= -4 + (-21) + 8$
$= -25 + 8$
$= -17$

39. $3 + (-21) = -18$

40. $12 + (-9) = 3$

41. $-5 + 16 = 11$

42. $-7 + 17 = 10$

43. $(-3) + (-8) + 12 = -11 + 12$
$= 1$

44. $5 + (-16) + (-13) = -11 + (-13)$
$= -24$

45. $x + (-7)$

46. $-a + b$

47. **a.** $-73{,}920{,}000{,}000 + (-68{,}668{,}000{,}000) = -142{,}588{,}000{,}000$
The total of the U.S. balance of trade in Japan and China is –142,588,000,000.

b. $-32{,}095{,}000{,}000 + (-28{,}305{,}000{,}000) = -60{,}400{,}000{,}000$
The total of the U.S. balance of trade with Canada and Germany is –60,400,000,000.

c. $-73{,}920{,}000{,}000 + (-28{,}305{,}000{,}000) = -102{,}225{,}000{,}000$
The total of the U.S. balance of trade with Japan and Germany is –102,225,000,000.

48. $x + y$
$-5 + (-7) = -12$

49. $-a + b$
$-(-8) + (-3) = 8 + (-3)$
$= 5$

50. $a + b$
$-8 + (-3) = -11$

51. $-x + y$
$-(-5) + (-7) = 5 + (-7)$
$= -2$

52. $a + b + c$
$-4 + 6 + (-9) = 2 + (-9)$
$= -7$

53. $a + b + c$
$-10 + (-6) + 5 = -16 + 5$
$= -11$

54. $x + y + (-z)$
$-3 + 6 + (-(-17)) = -3 + 6 + 17$
$= 3 + 17$
$= 20$

55. $-x + (-y) + z$
$-(-2) + (-8) + (-11) = 2 + (-8) + (-11)$
$= -6 + (-11)$
$= -17$

56. The Commutative Property of Addition

57. The Addition Property of Zero

58. The Inverse Property of Addition

59. The Associative Property of Addition

60. $-11 + (6 + 9) = (-11 + 6) + 9$

61. $-13 + 0 = -13$

62. $-2 + (-4) = -4 + (-2)$

63. $18 + (-18) = 0$

64. $$\begin{array}{c|c} x+4 & 1 \\ \hline -3+4 & 1 \\ 1 & 1 \end{array}$$
$1 = 1$
Yes, –3 is a solution of the equation $x + 4 = 1$.

65. $$\begin{array}{c|c} 6 & -3+z \\ \hline 6 & -3+(-8) \end{array}$$
$6 \neq -11$
No, –8 is not a solution of the equation $6 = -3 + z$.

66. $$\begin{array}{c|c} 6 & 12+n \\ \hline 6 & 12+(-6) \end{array}$$
$6 = 6$
Yes, –6 is a solution of the equation $6 = 12 + n$.

67. $$\begin{array}{c|c} -7+m & -15 \\ \hline -7+(-8) & -15 \end{array}$$
$-15 = -15$
Yes, –8 is a solution of the equation $-7 + m = -15$.

68. $$\begin{array}{c|c} 3+y & y+3 \\ \hline 3+(-2) & (-2)+3 \end{array}$$
$1 = 1$
Yes, –2 is a solution of the equation $3 + y = y + 3$.

69. $$\begin{array}{c|c} 1+z & z+2 \\ \hline 1+(-4) & -4+2 \end{array}$$
$-3 \neq -2$
No, –4 is not a solution of the equation $1 + z = z + 2$.

Objective B Exercises, pages 113–115

72. $7 - 14 = 7 + (-14)$
$= -7$

73. $6 - 9 = 6 + (-9)$
$= -3$

74. $-7 - 2 = -7 + (-2)$
$= -9$

75. $-9-4=-9+(-4)$
$=-13$

76. $7-(-2)=7+2$
$=9$

77. $3-(-4)=3+4$
$=7$

78. $-6-(-6)=-6+6$
$=0$

79. $-4-(-4)=-4+4$
$=0$

80. $-12-16=-12+(-16)$
$=-28$

81. $-10-7=-10+(-7)$
$=-17$

82. $(-9)-(-3)=-9+3$
$=-6$

83. $(-7)-(-4)=-7+4$
$=-3$

84. $4-(-14)=4+14$
$=18$

85. $-4-(-16)=-4+16$
$=12$

86. $(-14)-(-7)=-14+7$
$=-7$

87. $3-(-24)=3+24$
$=27$

88. $9-(-9)=9+9$
$=18$

89. $(-41)-65=-41+(-65)$
$=-106$

90. $57-86=57+(-86)$
$=-29$

91. $-95-(-28)=-95+28$
$=-67$

92. $5-(-11)=5+11$
$=16$

93. $-10-(-4)=-10+4$
$=-6$

94. $-13-(-8)=-13+8$
$=-5$

95. $-9-6=-9+(-6)$
$=-15$

96. $-y-5$

97. $-t-r$

98. $58-(-24)=58+24$
$=82$
The difference between the highest and lowest temperatures ever recorded in Africa in 82°C.

99. $49-(-33)=49+33$
$=82$
The difference between the highest and lowest temperatures ever recorded in South America is 82°C.

100. $-55-(-68)=-55+68$
$=13$
The difference between the lowest temperature recorded in Europe and the lowest temperature recorded in Asia is 13°C.

101. $-4-3-2=-4+(-3)+(-2)$
$=-7+(-2)$
$=-9$

102. $4-5-12=4+(-5)+(-12)$
$=-1+(-12)$
$=-13$

103. $12-(-7)-8=12+7+(-8)$
$=19+(-8)$
$=11$

104. $-12-(-3)-(-15)=-12+3+15$
$=-9+15$
$=6$

105. $4-12-(-8)=4+(-12)+8$
$=-8+8$
$=0$

106. $-30-(-65)-29-4$
$=-30+65+(-29)+(-4)$
$=35+(-29)+(-4)$
$=6+(-4)$
$=2$

107. $-16-47-63-12$
$=-16+(-47)+(-63)+(-12)$
$=-63+(-63)+(-12)$
$=-126+(-12)$
$=-138$

108. $42-(-30)-65-(-11)$
$=42+30+(-65)+11$
$=72+(-65)+11$
$=7+11$
$=18$

109. $12-(-6)+8=12+6+8$
$=18+8$
$=26$

110. $-7+9-(-3)=-7+9+3$
$=2+3$
$=5$

111. $-8-(-14)+7=-8+14+7$
$=6+7$
$=13$

112. $-4+6-8-2=-4+6+(-8)+(-2)$
$=2+(-8)+(-2)$
$=-6+(-2)$
$=-8$

113. $9-12+0-5=9+(-12)+0+(-5)$
$=-3+0+(-5)$
$=-3+(-5)$
$=-8$

114. $11-(-2)-6+10=11+2+(-6)+10$
$=13+(-6)+10$
$=7+10$
$=17$

115. $5+4-(-3)-7=5+4+3+(-7)$
$=9+3+(-7)$
$=12+(-7)$
$=5$

116. $-1-8+6-(-2)=-1+(-8)+6+2$
$=-9+6+2$
$=-3+2$
$=-1$

117. $-13+9-(-10)-4=-13+9+10+(-4)$
$=-4+10+(-4)$
$=6+(-4)$
$=2$

118. $6-(-13)-14+7=6+13+(-14)+7$
$=19+(-14)+7$
$=5+7$
$=12$

119. $-x-y$
$-(-3)-9=3+(-9)$
$=-6$

120. $x-(-y)$
$-3-(-9)=-3+9$
$=6$

121. $-x-(-y)$
$-(-3)-(-9)=3+9$
$=12$

122. $a-(-b)$
$-6-(-10)=-6+10$
$=4$

123. $a-b-c$
$4-(-2)-9=4+2+(-9)$
$=6+(-9)$
$=-3$

124. $a-b-c$
$-1-7-(-15)=-1+(-7)+15$
$=-8+15$
$=7$

125. $x-y-(-z)$
$-9-3-(-30)=-9+(-3)+30$
$=-12+30$
$=18$

126. $-x-(-y)-z$
$-8-(-1)-(-14)=-8+1+14$
$=-7+14$
$=7$

127.
$$\begin{array}{r|l} \multicolumn{2}{c}{x-7=-10} \\ \hline -3-7 & -10 \\ -3+(-7) & -10 \end{array}$$
$$-10=-10$$
Yes, -3 is a solution of the equation $x-7=-10$.

128.
$$\begin{array}{r|l} \multicolumn{2}{c}{1=3-y} \\ \hline 1 & 3-(-4) \\ 1 & 3+4 \end{array}$$
$$1\neq 7$$
No, -4 is not a solution of the equation $1=3-y$.

129.
$$\begin{array}{c|c} \multicolumn{2}{c}{-5 - w = 7} \\ \hline -5-(-2) & 7 \\ -5+2 & 7 \end{array}$$
$$-3 \neq 7$$
No, –2 is not a solution of the equation $-5 - w = 7$.

130.
$$\begin{array}{c|c} \multicolumn{2}{c}{-12 = m - 4} \\ \hline -12 & -8-4 \\ -12 & -8+(-4) \end{array}$$
$$-12 = -12$$
Yes, –8 is a solution of the equation $-12 = m - 4$.

131.
$$\begin{array}{c|c} \multicolumn{2}{c}{-t - 5 = 7 + t} \\ \hline -(-6)-5 & 7+(-6) \\ 6-5 & 7+(-6) \\ 6+(-5) & 7+(-6) \end{array}$$
$$1 = 1$$
Yes, –6 is a solution of the equation $-t - 5 = 7 + t$.

132.
$$\begin{array}{c|c} \multicolumn{2}{c}{5 + a = -9 - a} \\ \hline 5+(-7) & -9-(-7) \\ 5+(-7) & -9+7 \end{array}$$
$$-2 = -2$$
Yes, –7 is a solution of the equation $5 + a = -9 - a$.

Objective C Exercises, pages 115-116

133. Strategy

a. To find the difference, subtract the elevation of Death Valley (–86) from the elevation of Mt. Aconcagua (6,960).

b. To find the difference, subtract the elevation of the Qattara Depression (–133) from the elevation of Mt. Kilimangaro (5,895).

Solution

a. $6{,}960 - (-86) = 6{,}960 + 86$
$= 7{,}046$
The difference in elevation is 7,046 m.

b. $5{,}895 - (-133) = 5{,}895 + 133$
$= 6{,}028$
The difference in elevation is 6,028 m.

134. Strategy To determine for which continent the difference between the highest and lowest elevations is greatest:
→Find the difference between the highest and lowest elevation for each continent.
→Compare the differences.

Solution
Africa: $5{,}895 - (-113) = 5{,}895 + 133 = 6{,}028$
Asia: $8{,}848 - (-400) = 8{,}848 + 400 = 9{,}248$
Europe: $5{,}643 - (-28) = 5{,}643 + 28 = 5{,}671$
America: $6{,}960 - (-86) = 6{,}960 + 86 = 7{,}046$
$9{,}248 > 7{,}046 > 6{,}028 > 5{,}671$
The difference between the highest and lowest elevations is greatest in Asia.

135. Strategy To determine for which continent the difference between the highest and lowest elevations is smallest:
→Find the difference between the highest and lowest elevation for each continent.
→Compare the differences.

Solution
Africa: $5{,}895 - (-113) = 5{,}895 + 133 = 6{,}028$
Asia: $8{,}848 - (-400) = 8{,}848 + 400 = 9{,}248$
Europe: $5{,}643 - (-28) = 5{,}643 + 28 = 5{,}671$
America: $6{,}960 - (-86) = 6{,}960 + 86 = 7{,}046$
$5{,}671 < 6{,}028 < 7{,}046 < 9{,}248$
The difference between the highest and lowest elevations is smallest in Europe.

136. Strategy To find the temperature, add the increase (9) to the previous temperature (–6).

Solution $-6 + 9 = 3$
The temperature is 3°C.

137. Strategy To find the difference, subtract the average temperature at 40,000 ft (–70) from the average temperature at 12,000 ft (16).

Solution $16 - (-70) = 16 + 70 = 86$
The difference in temperature is 86°.

138. Strategy To find the difference, subtract the average temperature at 50,000 ft (–70) from the average temperature at 40,000 ft (–70).

Solution $-70 - (-70) = -70 + 70 = 0$
The difference in temperature is 0°.

139. Strategy To find how much colder, subtract the average temperature at 30,000 ft (–48) from the average temperature at 20,000 ft (–12).

Solution $-12 - (-48) = -12 + 48 = 36$
The temperature is 36° colder.

140. Strategy To find the golfer's score, substitute 196 for N and 208 for P in the given formula and solve for S.

Solution $S = N - P$
$S = 196 - 208$
$S = 196 + (-208)$
$S = -12$
The golfer's score is –12.

141. Strategy To find the golfer's score, substitute 49 for N and 52 for P in the given formula and solve for S.
$S = N - P$
$S = 49 - 52$
$S = 49 + (-52)$
$S = -3$
The golfer's score is –3.

142. Strategy To find d, replace a by 6 and b by –15 in the given formula and solve for d.

Solution $d = |a - b|$
$d = |6 - (-15)|$
$d = |6 + 15|$
$d = |21|$
$d = 21$
The distance between the two points is 21 units.

143. Strategy To find d, replace a by 7 and b by –12 in the given formula and solve for d.

Solution $d = |a - b|$
$d = |7 - (-12)|$
$d = |7 + 12|$
$d = |19|$
$d = 19$
The distance between the two points is 19 units.

Critical Thinking 2.2, page 116

144. To find the largest difference that can be obtained by subtracting one of the numbers 5, –2, –9, 11, or 14 from a different number in the same list of numbers, subtract the smallest number in the list from the largest.
$14 - (-9) = 14 + 9 = 23$

145. a. The opposite, or additive inverse, of 5 is –5. The difference between 5 and –5 is $5 - (-5) = 5 + 5 = 10$, which is not 0.
The additive inverse of 0 is 0. The difference between 0 and 0 is $0 - 0 = 0$.
The statement is sometimes true.

b. When adding two numbers with the same sign, we add the absolute values of the numbers and then attach the sign of the addends. When adding two negative numbers, the signs of the addends are negative. Therefore, we would attach a negative sign on the sum. The statement is always true.

143. Answers will vary. Possible answers include –1 and –6, –2 and –5, –3 and –4.

Section 2.3

Objective A Exercises, pages 123–125

3. $-4 \cdot 6 = -24$

4. $-7 \cdot 3 = -21$

5. $-2(-3) = 6$

6. $-5(-1) = 5$

7. $(9)(2) = 18$

8. $(3)(8) = 24$

9. $5(-4) = -20$

10. $4(-7) = -28$

11. $-8(2) = -16$

12. $-9(3) = -27$

13. $(-5)(-5) = 25$

14. $(-3)(-6) = 18$

15. $(-7)(0) = 0$

16. $-11(1) = -11$

17. $14(3) = 42$

18. $62(9) = 558$

19. $-32(4) = -128$

20. $-24(3) = -72$

21. $(-8)(-26) = 208$

22. $(-4)(-35) = 140$

23. $9(-27) = -243$

24. $8(-40) = -320$

25. $-5 \cdot (23) = -115$

26. $-6 \cdot (38) = -228$

27. $-7(-34) = 238$

28. $-4(-51) = 204$

29. $4 \cdot (-8) \cdot 3 = -32 \cdot 3$
$= -96$

30. $5 \cdot 7 \cdot (-2) = 35 \cdot (-2)$
$= -70$

31. $(-6)(5)(7) = -30(7)$
$= -210$

32. $(-9)(-9)(2) = 81(2)$
$= 162$

33. $-8(-7)(-4) = 56(-4)$
$= -224$

34. $-1(4)(-9) = -4(-9)$
$= 36$

35. $2(-20) = -40$

36. $100(-7) = -700$

37. $-30(-6) = 180$

38. $-9(-40) = 360$

39. $-q(r) = -qr$

40. $-f(g)(h) = -fg(h)$
$= -fgh$

41. **a.** $-4{,}144{,}000(4) = -16{,}576{,}000$
The annual net income for Barnes & Noble would be $-16{,}576{,}000$.

b. $-23{,}480{,}000(4) = -93{,}920{,}000$
The annual net income for Bradlees would be $-16{,}576{,}000$.

c. $-118{,}000{,}000(4) = -472{,}000{,}000$
The annual net income for J.C. Penney would be $-472{,}000{,}000$.

42. The Multiplication Property of Zero

43. The Multiplication Property of One

44. The Commutative Property of Multiplication

45. The Associative Property of Multiplication

46. $-3(-9) = -9(-3)$

47. $-6 \cdot (5 \cdot 10) = (-6 \cdot 5) \cdot 10$

48. $-81 \cdot 0 = 0$

49. $1(-14) = -14$

50. xy
$(-3)(-8) = 24$

51. $-xy$
$-(-3)(-8) = 3(-8)$
$= -24$

52. $x(-y)$
$(-3)(-(-8)) = (-3)(8)$
$= -24$

53. $-xyz$
$-(-6)(2)(-5) = 6(2)(-5)$
$= 12(-5)$
$= -60$

54. $-8a$
$-8(-24) = 192$

55. $-7n$
$-7(-51) = 357$

56. $5xy$
$5(-9)(-2) = -45(-2)$
$= 90$

57. $8ab$
$8(7)(-1) = 56(-1)$
$= -56$

58. $-4cd$
$-4(25)(-8) = -100(-8)$
$= 800$

59. $-5st$
$-5(-40)(-8) = 200(-8)$
$= -1{,}600$

60.
$$\begin{array}{c|c} \multicolumn{2}{c}{6m = -24} \\ \hline 6(-4) & -24 \end{array}$$
$-24 = -24$
Yes, -4 is a solution of the equation $6m = -24$.

61.
$$\begin{array}{c|c} \multicolumn{2}{c}{-5x = -15} \\ \hline -5(-3) & -15 \end{array}$$
$15 \neq -15$
No, -3 is not a solution of the equation $-5x = 15$.

62.
$$\begin{array}{c|c} \multicolumn{2}{c}{48 = -8y} \\ \hline 48 & -8(-6) \end{array}$$
$48 = 48$
Yes, -6 is a solution of the equation $48 = -8y$.

63.
$$\begin{array}{c|c} \multicolumn{2}{c}{-8 = -8a} \\ \hline -8 & -8(0) \end{array}$$
$-8 \neq 0$
No, 0 is not a solution of the equation $-8 = -8a$.

64.
$$\begin{array}{c|c} \multicolumn{2}{c}{-3c = 21} \\ \hline -3(7) & 21 \end{array}$$
$-21 \neq 21$
No, 7 is not a solution of the equation $-3c = 21$.

65.
$$\begin{array}{c|c} \multicolumn{2}{c}{-27 = -3c} \\ \hline -27 & -3(9) \end{array}$$
$-27 = -27$
Yes, 9 is a solution of the equation $-27 = -3c$.

Objective B Exercises, pages 125–127

66. $12 \div (-6) = -2$

67. $18 \div (-3) = -6$

68. $(-72) \div (-9) = 8$

69. $(-64) \div (-8) = 8$

70. $0 \div (-6) = 0$

71. $-49 \div 1 = -49$

72. $81 \div (-9) = -9$

73. $-40 \div (-5) = 8$

74. $\frac{72}{-3} = -24$

75. $\frac{44}{-4} = -11$

76. $\frac{-93}{-3} = 31$

77. $\frac{-98}{-7} = 14$

78. $-114 \div (-6) = 19$

79. $-91 \div (-7) = 13$

80. $-53 \div 0$ undefined

81. $(-162) \div (-162) = 1$

82. $-128 \div 4 = -32$

83. $-130 \div (-5) = 26$

84. $(-200) \div 8 = -25$

85. $(-92) \div (-4) = 23$

86. $\frac{-700}{70} = -10$

87. $\frac{550}{-5} = -110$

88. $\frac{-670}{-10} = 67$

89. $\frac{-333}{-3} = 111$

90. $\frac{-a}{b}$

91. $\frac{-9}{x}$

92. $-4{,}719{,}000 \div 3 = -1{,}573{,}000$
The average monthly net income for Brookstone was $-1{,}573{,}000$.

93. $-29{,}085{,}000 \div 3 = -9{,}695{,}000$
The average monthly net income for Ames was $-9{,}695{,}000$.

94. $a \div b$
$(-36) \div (-4) = 9$

95. $-a \div b$
$-(-36) \div (-4) = 36 \div (-4)$
$= -9$

96. $a \div (-b)$
$-36 \div (-(-4)) = -36 \div 4$
$= -9$

97. $(-a) \div (-b)$
$-(-36) \div (-(-4)) = 36 \div 4$
$= 9$

98. $\frac{x}{y}$
$\frac{-42}{-7} = 6$

99. $\frac{-x}{y}$
$\frac{-(-42)}{-7} = \frac{42}{-7}$
$= -6$

100. $\frac{x}{-y}$
$\frac{-42}{-(-7)} = \frac{-42}{7}$
$= -6$

101. $\frac{-x}{-y}$
$\frac{-(-42)}{-(-7)} = \frac{42}{7}$
$= 6$

102. $\frac{m}{-2} = -10$
$\begin{array}{c|c} \frac{20}{-2} & -10 \end{array}$
$-10 = -10$
Yes, 20 is a solution of the equation.

103. $6 = \frac{-c}{-3}$
$\begin{array}{c|c} 6 & \frac{-18}{-3} \end{array}$
$6 = 6$
Yes, 18 is a solution of the equation.

104. $0 = \frac{a}{-4}$
$\begin{array}{c|c} 0 & \frac{0}{-4} \end{array}$
$0 = 0$
Yes, 0 is a solution of the equation.

105. $\frac{21}{n} = 7$
$\begin{array}{c|c} \frac{21}{-3} & 7 \end{array}$
$-7 \neq 7$
No, -3 is not a solution of the equation.

106. $\frac{x}{2} = \frac{-18}{x}$
$\begin{array}{c|c} \frac{-6}{2} & \frac{-18}{-6} \end{array}$
$-3 \neq 3$
No, -6 is not a solution of the equation.

107. $\frac{m}{-4} = \frac{-16}{m}$
$\begin{array}{c|c} \frac{8}{-4} & \frac{-16}{8} \end{array}$
$-2 = -2$
Yes, 8 is a solution of the equation.

Objective C Exercises, pages 127–128

108. Strategy: To find the average score, divide the combined scores (–10) by the number of golfers (5).

Solution: $-10 \div 5 = -2$
The average golf score was –2.

109. Strategy: To find the average score, divide the combined scores (–12) by the number of golfers (4).

Solution: $-12 \div 4 = 3$
The average golf score was –3.

110. Strategy: To find the average record low temperature for July, August, and September.
→Add the average temperatures for July (10), August (5), and September (–9).
→Divide the sum by the number of months (3).

Solution: $10 + 5 + (-9) = 15 + (-9) = 6$
$6 \div 3 = 2$
The average record low temperature for July, August, and September is 2°F.

111. Strategy: To find the average record low temperature for the first three months of the year:
→Add the average temperatures for January (–70), February (–66), and March (–50).
→Divide the sum by the number of months (3).

Solution: $-70 + (-66) + (-50) = -136 + (-50) = -186$
$-186 \div 3 = -62$
The average record low temperature for the first three months of the year is –62°F.

112. Strategy: To find the average record low temperature for the four months with the lowest record low temperatures:
→Use the bar graph to find the four lowest record low temperatures.
→Add the four lowest record low temperatures.
→Divide the sum by the number of temperatures (4).

Solution: The four lowest record low temperatures are –70, –66, –59, and –53.
$-70 + (-66) + (-59) + (-53) = -136 + (-59) + (-53)$
$= -195 + (-53)$
$= -248$
$-248 \div 4 = -62$
The average record low temperature for the four months with the lowest record low temperatures is –62°F.

113. Strategy: To find the average daily low temperature for the week:
→Add the seven temperature readings.
→Divide by 7.

Solution: $4 + (-5) + 8 + (-1) + (-12) + (-14) + (-8) = -28$
$-28 \div 7 = -4$
The average daily low temperature for the week was –4°.

114. Strategy To find the average daily high temperature for the week:
→Add the seven temperature readings.
→Divide by 7.

Solution $-6 + (-11) + 1 + 5 + (-3) + (-9) + (-5) = -28$
$-28 \div 7 = -4$
The average daily high temperature for the week was $-4°$.

115. Strategy To find the wind chill factor, multiply the wind chill factor at 25°F with a 35 mph wind (−12) by 5.

Solution $-12 \cdot 5 = -60$
The wind chill factor is $-60°$F.

116. Strategy To find the next three numbers of the sequence:
→Find the multiplier by dividing the second number in the sequence (15) by the first number (−5).
→Use the multiplier to find the successive numbers in the sequence.

Solution $\frac{15}{-5} = -3$
$-45 \cdot (-3) = 135$
$135 \cdot (-3) = -405$
$-405 \cdot (-3) = 1{,}215$
The next three numbers in the sequence are 135, −405, and 1,215.

117. Strategy To find the next three numbers in the sequence:
→Find the multiplier by dividing the second number in the sequence (−4) by the first number (2).
→Use the multiplier to find the successive numbers in the sequence.

Solution $\frac{-4}{2} = -2$
$8 \cdot (-2) = -16$
$-16 \cdot (-2) = 32$
$32 \cdot (-2) = -64$
The next three numbers in the sequence are −16, 32, and −64.

118. Strategy To find the next three numbers in the sequence:
→Find the multiplier by dividing the second number in the sequence (−12) by the first number (−3).
→Use the multiplier to find the successive numbers in the sequence.

Solution $\frac{-12}{-3} = 4$
$-48 \cdot 4 = -192$
$-192 \cdot 4 = -768$
$-768 \cdot 4 = -3{,}072$
The next three numbers in the sequence are −192, −768, and −3,072.

119. Strategy To find the next three numbers in the sequence:
→Find the multiplier by dividing the second number in the sequence (–5) by the first number (–1).
→Use the multiplier to find the successive numbers in the sequence.

Solution $\frac{-5}{-1} = 5$
$-25 \cdot 5 = -125$
$-125 \cdot 5 = -625$
$-625 \cdot 5 = -3{,}125$
The next three numbers in the sequence are –125, –625, and –3,125.

Critical Thinking 2.3, page 129

120. Answers will vary. For example:
5 and –2 have different signs.
The product of 5 and –2 is $5(-2) = (-2) + (-2) + (-2) + (-2) + (-2) = -10$, which is a negative number.

121. a. We are looking for the largest possible product of two negative integers whose sum is –18. Find pairs of negative integers whose sum is –18 and look for a pattern.
$-17 + (-1) = -18$; $(-17)(-1) = 18$
$-16 + (-2) = -18$; $(-16)(-2) = 32$
$-15 + (-3) = -18$; $(-15)(-3) = 45$ The numbers are increasing.
⋮
$-10 + (-8) = -18$; $(-10)(-8) = 80$
$-9 + (-9) = -18$; $(-9)(-9) = 81$
$-8 + (-10) = -18$; $(-8)(-10) = 80$
$-7 + (-11) = -18$; $(-7)(-11) = 77$ The numbers are decreasing.
The largest possible product of two negative integers whose sum is –18 is 81.

b. We are looking for the smallest possible sum of two negative integers whose product is 16. List all the possible pairs of negative integers whose product is 16.
$-16(-1) = 16$; $-16 + (-1) = -17$
$-8(-2) = 16$; $-8 + (-2) = -10$
$-4(-4) = 16$; $-4 + (-4) = -8$
Of the numbers –17, –10, and –8, –17 is the smallest number.
The smallest possible sum of two negative integers whose product is 16 is –17.

122. a. The additive inverse of 5 is –5, and the product of 5 and –5 is –25, which is a negative number.
The additive inverse of 0 is 0, and the product of 0 and 0 is 0, which is not a negative number.
The statement is sometimes true.

b. If we multiply two negative numbers, the product is positive. If we multiply this product by a negative number, we are multiplying a positive number times a negative number; the product is negative.
Therefore, the product of three negative numbers is a negative number.
Consider multiplying the product of three negative numbers by two more negative numbers.
The product of the two additional negative numbers is positive, so we are multiplying a negative times a positive.
The product is a negative number.
To have an odd number of negative numbers, we must keep multiplying by two more negative numbers, whose product is always positive. The product will always be negative.
The statement is always true.

c. If a negative number is squared, it is multiplied by itself.
So in squaring a negative number, we are multiplying a negative number times a negative number.
The product of two numbers with the same sign is positive.
The statement is always true.

123. By substituting negative integers for x in the inequality $1 - 3x < 12$, it can be shown that -3, -2, and -1 are the only negative integers that satisfy the inequality.

Section 2.4

Objective A Exercises, page 133

1. $x - 6 = 9$
$x - 6 + 6 = 9 + 6$
$x = 15$
The solution is 15.

2. $m - 4 = 6$
$m - 4 + 4 = 6 + 4$
$m = 10$
The solution is 10.

3. $8 = y - 3$
$8 + 3 = y - 3 + 3$
$11 = y$
The solution is 11.

4. $12 = t - 4$
$12 + 4 = t - 4 + 4$
$16 = t$
The solution is 16.

5. $x - 5 = -12$
$x - 5 + 5 = -12 + 5$
$x = -7$
The solution is -7.

6. $n - 7 = -21$
$n - 7 + 7 = -21 + 7$
$n = -14$
The solution is -14.

7. $-10 = z + 6$
$-10 - 6 = z + 6 - 6$
$-16 = z$
The solution is -16.

8. $-21 = c + 4$
$-21 - 4 = c + 4 - 4$
$-25 = c$
The solution is -25.

9. $x + 12 = 4$
$x + 12 - 12 = 4 - 12$
$x = -8$
The solution is -8.

10. $y + 7 = 2$
$y + 7 - 7 = 2 - 7$
$y = -5$
The solution is -5.

11. $-12 = c - 12$
$-12 + 12 = c - 12 + 12$
$0 = c$
The solution is 0.

12. $n - 9 = -9$
$n - 9 + 9 = -9 + 9$
$n = 0$
The solution is 0.

13. $6 + x = 4$
$6 + x - 6 = 4 - 6$
$x = -2$
The solution is -2.

14. $12 + y = 7$
$12 + y - 12 = 7 - 12$
$x = -5$
The solution is -5.

15. $12 = n - 8$
$12 + 8 = n - 8 + 8$
$20 = n$
The solution is 20.

16. $19 = b - 23$
$19 + 23 = b - 23 + 23$
$42 = b$
The solution is 42.

17. $3m = -15$
$\frac{3m}{3} = \frac{-15}{3}$
$m = -5$
The solution is -5.

18. $6p = -54$
$\frac{6p}{6} = \frac{-54}{6}$
$p = -9$
The solution is -9.

19. $-10 = 5v$
$\frac{-10}{5} = \frac{5v}{5}$
$-2 = v$
The solution is –2.

20. $-20 = 2z$
$\frac{-20}{2} = \frac{2z}{2}$
$-10 = z$
The solution is –10.

21. $-8x = -40$
$\frac{-8x}{-8} = \frac{-40}{-8}$
$x = 5$
The solution is 5.

22. $-4y = -28$
$\frac{-4y}{-4} = \frac{-28}{-4}$
$y = 7$
The solution is 7.

23. $-60 = -6v$
$\frac{-60}{-6} = \frac{-6v}{-6}$
$10 = v$
The solution is 10.

24. $3x = -39$
$\frac{3x}{3} = \frac{-39}{3}$
$x = -13$
The solution is –13.

25. $5x = -100$
$\frac{5x}{5} = \frac{-100}{5}$
$x = -20$
The solution is –20.

26. $-4n = 0$
$\frac{-4n}{-4} = \frac{0}{-4}$
$n = 0$
The solution is 0.

27. $4x = 0$
$\frac{4x}{4} = \frac{0}{4}$
$x = 0$
The solution is 0.

28. $-15 = -15z$
$\frac{-15}{-15} = \frac{-15z}{-15}$
$y = 1$
The solution is 1.

29. $-2r = 16$
$\frac{-2r}{-2} = \frac{16}{-2}$
$r = -8$
The solution is –8.

30. $-6p = 72$
$\frac{-6r}{-6} = \frac{72}{-6}$
$p = -12$
The solution is –12.

31. $-72 = 18w$
$\frac{-72}{18} = \frac{18w}{18}$
$-4 = w$
The solution is –4.

32. $-35 = 5p$
$\frac{-35}{5} = \frac{5p}{5}$
$-7 = p$
The solution is –7.

Objective B Exercise, page 133-134

33. The unknown number: n
$\boxed{\text{ten less than a number}}$ is $\boxed{\text{fifteen}}$
$n - 10 = 15$
$n - 10 + 10 = 15 + 10$
$n = 25$
The number is 25.

34. The unknown number: n
$\boxed{\text{the difference between a number and five}}$ is $\boxed{\text{twenty-two}}$
$n - 5 = 22$
$n - 5 + 5 = 22 + 5$
$n = 27$
The number is 27.

35. The unknown number: n
$\boxed{\text{zero}}$ is equal to $\boxed{\text{fifteen more than some number}}$
$0 = n + 15$
$0 - 15 = n + 15 - 15$
$-15 = n$
The number is –15.

36. The unknown number: n

twenty	equals	the sum of a number and thirty-one

$20 = n + 31$
$20 - 31 = n + 31 - 31$
$-11 = n$
The number is –11.

37. The unknown number: n

sixteen	equals	negative two times a number

$16 = -2n$
$\frac{16}{-2} = \frac{-2n}{-2}$
$-8 = n$
The number is –8.

38. The unknown number: n

the product of negative six and a number	is	negative forty-two

$-6n = -42$
$\frac{-6n}{-6} = \frac{-42}{-6}$
$n = 7$
The number is 7.

39. The unknown number: n

zero	is equal to	the product of negative six and a number

$0 = -6n$
$\frac{0}{-6} = \frac{-6n}{-6}$
$0 = n$
The number is 0.

40. The unknown number: n

eight times some number	is	negative ninety-six

$8n = -96$
$\frac{8n}{8} = \frac{-96}{8}$
$n = -12$
The number is –12.

41. Strategy To find the U.S. balance of trade in 1998, write and solve an equation using x to represent the U.S. balance of trade in 1998.

Solution

the balance of trade in 1950	was	\$230,843 million more than the balance of trade in 1998

$1{,}043 = x + 230{,}843$
$1{,}043 - 230{,}843 = x + 230{,}843 - 230{,}843$
$-229{,}800 = x$
The U.S. balance of trade in 1998 was –\$229,800 million.

42. Strategy To find the U.S. balance of trade in 1999, write and solve an equation using x to represent the U.S. balance of trade in 1999.

Solution

the balance of trade in 1980	was	\$305,755 million more than the balance of trade in 1999.

$-24{,}245 = x + 305{,}755$
$-24{,}245 - 305{,}755 = x + 305{,}755 - 305{,}755$
$-330{,}000 = x$
The U.S. balance of trade in 1999 was –\$330,000 million.

43. Strategy To find this morning's temperature, write and solve an equation using x to represent this morning's temperature.

Solution

the temperature now	is	5° higher than it was in this morning

$8 = x + 5$
$8 - 5 = x + 5 - 5$
$3 = x$
The temperature this morning was 3°C.

44. Strategy To find yesterday's temperature, write and solve an equation using x to represent yesterday's temperature.

Solution

the temperature now	is	9° lower than it was yesterday

$-16 = x - 9$
$-16 + 9 = x - 9 + 9$
$-7 = x$
The temperature yesterday was –7°C.

45. Strategy To find the selling price of the car, replace P by 925 and C by 12,600 in the given formula and solve for S.

Solution $P = S - C$
$925 = S - 12{,}600$
$925 + 12{,}600 = S - 12{,}600 + 12{,}600$
$13{,}525 = S$
The selling price of the car should be $13,525.

46. Strategy To find the selling price of the software, replace P by 95 and C by 385 in the given formula and solve for S.

Solution $P = S - C$
$95 = S - 385$
$95 + 385 = S - 385 + 385$
$480 = S$
The selling price of the software should be $480.

47. Strategy To find the assets, replace N by 11 and L by 4 in the given formula and solve for A.

Solution $N = A - L$
$11 = A - 4$
$11 + 4 = A - 4 + 4$
$15 = A$
The assets are $15 million.

48. Strategy To find the assets, replace N by 43 and L by 14 in the given formula and solve for A.

Solution $N = A - L$
$43 = A - 14$
$43 + 14 = A - 14 + 14$
$57 = A$
The assets are $57 million.

Critical Thinking 2.4, page 134

49. a. False. For example, the solution of the equation $5x = 0$ is 0.

 b. False. For example, the solution of the equation $5x = -5$ is -1, a negative number.

 c. False. For example, the solution of the equation $-5x = -5$ is 1, a positive number.

50. a. $-3y = -36$
$$\frac{-3y}{-3} = \frac{-36}{-3}$$
$y = 12$
$3y - 8$
$3(12) - 8 = 36 - 8$
$= 28$

 b. $x - 6 = -9$
$x - 6 + 6 = -9 + 6$
$x = -3$
$2x^2 - 18$
$2(-3)^2 - 18 = 2(9) - 18$
$= 18 - 18$
$= 0$

Section 2.5

Objective A Exercises, pages 137–138

1. $3 - 12 \div 2 = 3 - 6$
$= 3 + (-6)$
$= -3$

2. $-16 \div 2 + 8 = -8 + 8$
$= 0$

3. $2(3 - 5) - 2 = 2(-2) - 2$
$= -4 - 2$
$= -4 + (-2)$
$= -6$

4. $2 - (8 - 10) \div 2 = 2 - (-2) \div 2$
$= 2 - (-1)$
$= 2 + 1$
$= 3$

5. $4 - (-3)^2 = 4 - 9$
$= 4 + (-9)$
$= -5$

6. $(-2)^2 - 6 = 4 - 6$
$= 4 + (-6)$
$= -2$

7. $4 \cdot (2 - 4) - 4 = 4 \cdot (-2) - 4$
$= -8 - 4$
$= -8 + (-4)$
$= -12$

8. $6 - 2 \cdot (1 - 3) = 6 - 2 \cdot (-2)$
$= 6 - (-4)$
$= 6 + 4$
$= 10$

9. $4 - (-2)^2 + (-3) = 4 - 4 + (-3)$
$= 4 + (-4) + (-3)$
$= 0 + (-3)$
$= -3$

10. $-3 + (-6)^2 - 1 = -3 + 36 - 1$
$= -3 + 36 + (-1)$
$= 33 + (-1)$
$= 32$

11. $3^3 - 4(2) = 27 - 4(2)$
$= 27 - 8$
$= 27 + (-8)$
$= 19$

12. $9 \div 3 - (-3)^2 = 9 \div 3 - 9$
$= 3 - 9$
$= 3 + (-9)$
$= -6$

13. $3 \cdot (6 - 2) \div 6 = 3 \cdot 4 \div 6$
$= 12 \div 6$
$= 2$

14. $4 \cdot (2 - 7) \div 5 = 4 \cdot (-5) \div 5$
$= (-20) \div 5$
$= -4$

15. $2^3 - (-3)^2 + 2 = 8 - 9 + 2$
$= 8 + (-9) + 2$
$= -1 + 2$
$= 1$

16. $6(8 - 2) \div 4 = 6(6) \div 4$
$= 36 \div 4$
$= 9$

17. $6-2(1-5)=6-2(-4)$
$=6-(-8)$
$=6+8$
$=14$

18. $(-2)^2-(-3)^2+1=4-9+1$
$=4+(-9)+1$
$=-5+1$
$=-4$

19. $6-(-4)(-3)^2=6-(-4)(9)$
$=6-(-36)$
$=6+36$
$=42$

20. $4-(-5)(-2)^2=4-(-5)(4)$
$=4-(-20)$
$=4+20$
$=24$

21. $4\cdot 2-3\cdot 7=8-3\cdot 7$
$=8-21$
$=8+(-21)$
$=-13$

22. $16\div 2-9\div 3=8-9\div 3$
$=8-3$
$=8+(-3)$
$=5$

23. $(-2)^2-5(3)-1=4-5(3)-1$
$=4-15-1$
$=4+(-15)+(-1)$
$=-11+(-1)$
$=-12$

24. $4-2\cdot 7-3^2=4-2\cdot 7-9$
$=4-14-9$
$=4+(-14)+(-9)$
$=-10+(-9)$
$=-19$

25. $3\cdot 2^3+5\cdot(3+2)-17=3\cdot 2^3+5\cdot 5-17$
$=3\cdot 8+5\cdot 5-17$
$=24+5\cdot 5-17$
$=24+25-17$
$=24+25+(-17)$
$=49+(-17)$
$=32$

26. $3\cdot 4^2-16-4+3-(1-2)^2$
$=3\cdot 4^2-16-4+3-(-1)^2$
$=3\cdot 16-16-4+3-1$
$=48-16-4+3-1$
$=48+(-16)+(-4)+3+(-1)$
$=32+(-4)+3+(-1)$
$=28+3+(-1)$
$=31+(-1)$
$=30$

27. $-12(6-8)+1^3\cdot 3^2\cdot 2-6(2)$
$=-12(-2)+1^3\cdot 3^2\cdot 2-6(2)$
$=-12(-2)+1\cdot 9\cdot 2-6(2)$
$=24+1\cdot 9\cdot 2-6(2)$
$=24+18-6(2)$
$=24+18-12$
$=24+18+(-12)$
$=42+(-12)$
$=30$

28. $-3\cdot(-2)^2\cdot 4\div 8-(-12)$
$=-3\cdot 4\cdot 4\div 8-(-12)$
$=-12\cdot 4\div 8-(-12)$
$=-48\div 8-(-12)$
$=-6-(-12)$
$=-6+12$
$=6$

29. $-27-(-3)^2-2-7+6\cdot 3$
$=-27-9-2-7+6\cdot 3$
$=-27-9-2-7+18$
$=-27+(-9)+(-2)+(-7)+18$
$=-36+(-2)+(-7)+18$
$=-38+(-7)+18$
$=-45+18$
$=-27$

30. $(-1)\cdot(4-7)^2\div 9+6-3-4(2)$
$=(-1)\cdot(-3)^2\div 9+6-3-4(2)$
$=(-1)\cdot 9\div 9+6-3-4(2)$
$=-9\div 9+6-3-4(2)$
$=-1+6-3-4(2)$
$=-1+6-3-8$
$=-1+6+(-3)+(-8)$
$=5+(-3)+(-8)$
$=2+(-8)$
$=-6$

31. $16-4\cdot 8+4^2-(-18)-(-9)$
$=16-4\cdot 8+16-(-18)-(-9)$
$=16-32+16-(-18)-(-9)$
$=16+(-32)+16+18+9$
$=-16+16+18+9$
$=0+18+9$
$=18+9$
$=27$

32. $(-3)^2 \cdot (5-7)^2 - (-9) \div 3$
$= (-3)^2 \cdot (-2)^2 - (-9) \div 3$
$= 9 \cdot 4 - (-9) \div 3$
$= 36 - (-9) \div 3$
$= 36 - (-3)$
$= 36 + 3$
$= 39$

33. $3a + 2b$
$3(-2) + 2(4) = -6 + 2(4)$
$= -6 + 8$
$= 2$

34. $a - 2c$
$-2 - 2(-1) = -2 - (-2)$
$= -2 + 2$
$= 0$

35. $16 \div (ac)$
$16 \div ((-2)(-1)) = 16 \div 2$
$= 8$

36. $6b \div (-a)$
$6(4) \div (-(-2)) = 6(4) \div 2$
$= 24 \div 2$
$= 12$

37. $bc \div (2a)$
$4(-1) \div ((2)(-2)) = 4(-1) \div (-4)$
$= (-4) \div (-4)$
$= 1$

38. $a^2 - b^2$
$(-2)^2 - 4^2 = 4 - 16$
$= 4 + (-16)$
$= -12$

39. $b^2 - c^2$
$4^2 - (-1)^2 = 16 - 1$
$= 16 + (-1)$
$= 15$

40. $2a - (c+a)^2$
$2(-2) - (-1 + (-2))^2 = 2(-2) - (-3)^2$
$= 2(-2) - 9$
$= -4 - 9$
$= -4 + (-9)$
$= -13$

41. $(b-a)^2 + 4c$
$(4-(-2))^2 + 4(-1) = (4+2)^2 + 4(-1)$
$= 6^2 + 4(-1)$
$= 36 + 4(-1)$
$= 36 + (-4)$
$= 32$

42. $\frac{b+c}{d}$
$\frac{4+(-1)}{3} = \frac{3}{3}$
$= 1$

43. $\frac{d-b}{c}$
$\frac{3-4}{-1} = \frac{3+(-4)}{-1}$
$= \frac{-1}{-1}$
$= 1$

44. $\frac{2d+b}{-a}$
$\frac{2(3)+4}{-(-2)} = \frac{6+4}{2}$
$= \frac{10}{2}$
$= 5$

45. $\frac{b-d}{c-a}$
$\frac{4-3}{-1-(-2)} = \frac{4+(-3)}{-1+2}$
$= \frac{1}{1}$
$= 1$

46. $\frac{bd}{a} \div c$
$\frac{4(3)}{-2} \div (-1) = \frac{12}{-2} \div (-1)$
$= -6 \div (-1)$
$= 6$

47. $(d-a)^2 \div 5$
$(3-(-2))^2 \div 5 = (3+2)^2 \div 5$
$= 5^2 \div 5$
$= 25 \div 5$
$= 5$

48. $(b+c)^2+(a+d)^2$

$(4+(-1))^2+(-2+3)^2$
$=3^2+1^2$
$=9+1$
$=10$

49. $(d-a)^2-3c$

$(3-(-2))^2-3(-1)$
$=(3+2)^2-3(-1)$
$=5^2-3(-1)$
$=25-3(-1)$
$=25-(-3)$
$=25+3$
$=28$

50. $(b+d)^2-4a$

$(4+3)^2-4(-2)=7^2-4(-2)$
$=49-4(-2)$
$=49-(-8)$
$=49+8$
$=57$

Critical Thinking 2.5, page 138

51. $-2^2-(-3)^2+5(4)\div 10-(-6)=-4-9+5(4)\div 10-(-6)$
$=-4-9+20\div 10-(-6)$
$=-4-9+2-(-6)$
$=-4+(-9)+2+6$
$=-13+2+6$
$=-11+6=-5$
We are looking for the smallest integer greater than –5.
The smallest integer greater than –5 is –4.
The smallest integer greater than $-2^2-(-3)^2+5(4)\div 10-(-6)$ is –4.

52. **a.** $1^3+2^3+3^3+4^3=1+8+27+64=100$

b. $(-1)^3+(-2)^3+(-3)^3+(-4)^3=-1+(-8)+(-27)+(-64)=-100$

c. $1^3+2^3+3^3+4^3+5^3=1+8+27+64+125=225$

d. The answer to **b** was the opposite of the answer to **a**.
$(-1)^3+(-2)^2+(-3)^3+(-4)^3+(-5)^3=-225$, the opposite of the answer to **c**.

53. a.

$$\begin{array}{r|l} \multicolumn{2}{c}{x^2-2x-8=0} \\ \hline (-4)^2-2(-4)-8 & 0 \\ 16-2(-4)-8 & 0 \\ 16+8-8 & 0 \\ 24-8 & 0 \end{array}$$

$$16 \neq 0$$

No, –4 is not a solution of the equation.

b.

$$\begin{array}{r|l} \multicolumn{2}{c}{x^3+3x^2-5x-15=0} \\ \hline (-3)^3+3(-3)^2-5(-3)-15 & 0 \\ -27+3(9)-5(-3)-15 & 0 \\ -27+27+15-15 & 0 \\ 0+15-15 & 0 \\ 15-15 & 0 \end{array}$$

$$0=0$$

Yes, –3 is not a solution of the equation.

Chapter Review Exercises, pages 143–144

1. eight minus negative one

2. $-|-36|=-36$

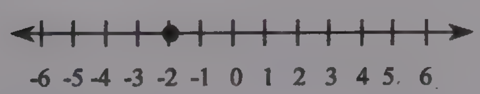
3. $(-40)(-5)=200$

4. $-a \div b$
$-(-27)\div(-3)=27\div(-3)$
$=-9$

5. $-28+14=-14$

6. $-(-13)=13$

7.



8. $-24=-6y$
$\frac{-24}{-6}=\frac{-6y}{-6}$
$4=y$
The solution is 4.

9. $-51\div(-3)=17$

10. $\frac{840}{-4}=-210$

11. $-6-(-7)-15-(-12)$
$=-6+7+(-15)+12$
$=1+(-15)+12$
$=-14+12$
$=-2$

12. $-ab$
$-(-2)(-9)=2(-9)$
$=-18$

13. $18+(-13)+(-6)=5+(-6)$
$=-1$

14. $-18(4)=-72$

15. $(-2)^2-(-3)^2\div(1-4)^2\cdot 2-6$
$=(-2)^2-(-3)^2\div(-3)^2\cdot 2-6$
$=4-9\div 9\cdot 2-6$
$=4-1\cdot 2-6$
$=4-2-6$
$=4+(-2)+(-6)$
$=2+(-6)$
$=-4$

16. $-x-y$
$-(-1)-3=1-3$
$=1+(-3)$
$=-2$

17. $5-(-3)=5+3$
$=8$
The difference between the number of strokes made by Pitcock and the number by King is 8 strokes.

18. $-15-(-28)=-15+28$
$=13$

19. The Commutative Property of Multiplication

20.

$$\begin{array}{r|l} \multicolumn{2}{c}{-6-t=3} \\ \hline -6-(-9) & 3 \\ -6+9 & 3 \end{array}$$

$$3=3$$

Yes, –9 is a solution of the equation $-6-t=3$.

21. $-9+16-(-7)=-9+16+7$
$=7+7$
$=14$

22. $\frac{0}{-17}=0$

23. $-5(2)(-6)(-1)=-10(-6)(-1)$
$=60(-1)$
$=-60$

24. $3+(-9)+4+(-10)=-6+4+(-10)$
$=-2+(-10)$
$=-12$

25. $(a-b)^2-2a$
$(-2-(-3))^2-2(-2)$
$=(-2+3)^2-2(-2)$
$=1^2-2(-2)$
$=1-2(-2)$
$=1-(-4)$
$=1+4$
$=5$

26. $-8>-10$

27. $-21+21=0$

28. $|-27|=27$

29. The unknown number: n

forty-eight	is	the product of negative six and some number

$48=-6n$
$\frac{48}{-6}=\frac{-6n}{-6}$
$-8=n$
The number is –8.

30. Strategy To find the colder temperature, compare the numbers –4 and –12. The smaller number represents the colder temperature.

Solution $-4>-12$
The colder temperature is –12°C.

31. Strategy To find the boiling point of neon:
→Find the highest boiling point shown in the table.
→Multiply the highest boiling point by 7.

Solution The highest boiling point shown in the table is –35°.
$-35(7)=-245$
The boiling point of neon is –245°C.

32. Strategy To find the temperature, add the increase (5) to the previous temperature (–8).

Solution $-8+5=-3$
The temperature is –3°C.

33. Strategy To find d, replace a by 7 and b by –5 in the given formula and solve for d.

Solution $d=|a-b|$
$d=|7-(-5)|$
$d=|7+5|$
$d=|12|$
$d=12$
The distance between the two points is 12 units.

Chapter Test, pages 145–146

1. negative three plus negative five

2. $-|-34|=-34$

3. $3-(-15)=3+15$
$=18$

4. $a+b$
$(-11)+(-9)=-20$

5. $(-x)(-y)$
$(-(-4))\cdot(-(-6))=4\cdot 6$
$=24$

6. The Commutative Property of Addition

7. $-360\div -30=12$

8. $-3+-6+11=-9+11$
$=2$

9. $16>-19$

10. $7-(-3)-12=7+3-12$
$=10-12$
$=-2$

11. $a-b-c$
$=6-(-2)-11=6+2-11$
$=8-11$
$=-3$

12. $-(-49)=49$

13. $50\cdot(-5)=-250$

14. $-|5|, -(3), |-9|, -(-11)$

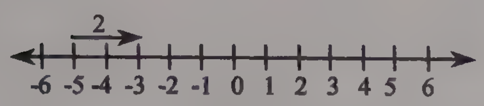
15. $17 - x = 8$

$$\begin{array}{c|c} 17-(-9) & 8 \\ 17+9 & 8 \end{array}$$

$26 \neq 8$

No, –9 is not a solution of the equation $17 - x = 8$.

16.



–3 is 2 units to the right of –5.

17. Strategy: To find the difference in scores, Woods' score (–19) from Nicklaus' score (5).

Solution: $5 - (-19) = 5 + 19$
$= 24$
The difference in scores was 24 strokes.

18. $\dfrac{0}{-16} = 0$

19. $2bc - (c - a)^3$
$(2 \cdot 4 \cdot (-1)) - (-1 + (-2))^3 = -8 - (-3)^3$
$= -8 - (-27)$
$= -8 + 27$
$= 19$

20. –25

21. $c - 11 = 5$
$c - 11 + 11 = 5 + 11$
$c = 16$
The solution is 16.

22. $0 - 11 = -11$

23. $-96 \div (-4) = 24$

24. $16 \div 4 - 12 \div (-2) = 4 - (-6)$
$= 4 + 6$
$= 10$

25. $\dfrac{-x}{y}$

$\dfrac{-(-56)}{-8} = \dfrac{56}{-8}$
$= -7$

26. $3xy$
$3 \cdot (-2) \cdot (-10) = 3 \cdot 20$
$= 60$

27. $-11w = 121$
$\dfrac{-11w}{-11} = \dfrac{121}{-11}$
$w = 11$
The solution is 11.

28. $4 - 14 = -10$

29. Strategy: To find the temperature, add the increase (11) to the previous temperature (–6).

Solution: $-6 + 11 = 5$
The temperature is 5°C.

30. The unknown number: n

the wind chill at –30°F with a 40 mph wind	is	Four times the wind chill factor at –30°F with a 40 mph wind

$n = 4 \cdot (-25)$
$n = -100$
The wind chill factor is –100°F.

31. Strategy: To find the temperature from yesterday, add the increase (8) to today's temperature (–13).

Solution: $-13 + 8 = -5$
The temperature is –5°C.

32. $d = |a - b|$
$d = |4 - (-12)| = |4 + 12|$
$= |16|$
$= 16$
The solution is 16.

33. Strategy: To find the assets, substitute 18 for N and 6 for L in the given formula and solve for A.

Solution: $N = A - L$
$18 = A - 6$
$18 + 6 = A - 6 + 6$
$24 = A$
The assets are worth \$24 million.

Cumulative Review Exercises, pages 147–148

1. $-27 - (-32) = -27 + 32$
$= 5$

2. $439 \rightarrow 400$
$28 \rightarrow 30$
$400 \cdot 30 = 12{,}000$

3. $$\begin{array}{r} 3{,}209 \\ 6\overline{)\,19{,}254} \\ \underline{-18} \\ 12 \\ \underline{-12} \\ 5 \\ \underline{-0} \\ 54 \\ \underline{-54} \\ 0 \end{array}$$

4. $16 \div (3+5) \cdot 9 - 2^4 = 16 \div 8 \cdot 9 - 2^4$
$= 16 \div 8 \cdot 9 - 16$
$= 2 \cdot 9 - 16$
$= 18 - 16$
$= 18 + (-16)$
$= 2$

5. $-|-82| = -82$

6. 309,480

7. $5xy$
$5 \cdot 80 \cdot 6 = 400 \cdot 6$
$= 2{,}400$

8. $-294 \div (-14) = 21$

9. $-28 - (-17) = -28 + 17$
$= -11$

10. $-24 + 16 + (-32) = -8 + (-32)$
$= -40$

11. $44 \div 1 = 44$
$44 \div 2 = 22$
$44 \div 4 = 11$
$44 \div 11 = 4$
The factors of 44 are 1, 2, 4, 11, 22, and 44.

12. x^4y^2
$2^4 \cdot 11^2 = (2 \cdot 2 \cdot 2 \cdot 2) \cdot (11 \cdot 11)$
$= 16 \cdot 121$
$= 1{,}936$

13. 629,874 Given place value
8 > 5
629,874 rounded to the nearest thousand is 630,000.

14. $$\begin{array}{rcr} 356 & \rightarrow & 400 \\ 481 & \rightarrow & 500 \\ 294 & \rightarrow & 300 \\ 117 & \rightarrow & \underline{+100} \\ & & 1{,}300 \end{array}$$

15. $-a - b$
$-(-4) - (-5) = 4 + 5$
$= 9$

16. $-100 \cdot 25 = -2{,}500$

17. $$\begin{array}{r} 23 \\ 3\overline{)69} \end{array}$$
$69 = 3 \cdot 23$

18. $3x = -48$
$\frac{3x}{3} = \frac{-48}{3}$
$x = -16$
The solution is –16.

19. $(1-5)^2 \div (-6+4) + 8(-3)$
$= (-4)^2 \div (-2) + 8(-3) = 16 \div (-2) + 8(-3)$
$= -8 + 8(-3)$
$= -8 + (-24)$
$= -32$

20. $-c \div d$
$-(-32) \div (-8) = 32 \div (-8)$
$= -4$

21. $\frac{a}{b}$
$\frac{39}{-13} = -3$

22. $-62 < 26$

23. $-18(-7) = 126$

24. $12 + p = 3$
$12 - 12 + p = 3 - 12$
$p = -9$
The solution is –9.

25. $2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 7 \cdot 7 = 2^5 \cdot 7^2$

26. $4a + (a-b)^3$
$4(5) + (5-2)^3 = 4(5) + 3^3$
$= 4(5) + 27$
$= 20 + 27$
$= 47$

27. $\begin{array}{r} 5{,}971 \\ 482 \\ +3{,}609 \\ \hline 10{,}062 \end{array}$

28. $-21-5=-21+(-5)$
$=-26$

29. $7{,}352 \rightarrow 7{,}000$
$1{,}986 \rightarrow -2{,}000$
$5{,}000$

30. $3^4 \cdot 5^2 = (3\cdot3\cdot3\cdot3)\cdot(5\cdot5)$
$= 81 \cdot 25$
$= 2{,}025$

31. Strategy To find the land area, add the land area prior to the purchase (891,364) to the amount of land purchased (831,321).

Solution $\begin{array}{r} 891{,}364 \\ +831{,}321 \\ \hline 1{,}722{,}685 \end{array}$

The land area of the United States after the Louisiana purchase was 1,722,685 mi^2.

32. Strategy To find the age, subtract the year of the birth (1879) from the year of his death (1955).

Solution $\begin{array}{r} 1955 \\ -1879 \\ \hline 76 \end{array}$

Albert Einstein was 76 years old when he died.

33. Strategy To find the amount, subtract the down payment (3,550) from the cost (17,750).

Solution $\begin{array}{r} 17{,}750 \\ -3{,}550 \\ \hline 14{,}200 \end{array}$

The amount to be paid is $14,200.

34. Strategy To find the cost of the land, multiply the number of acres (25) times the cost per acre (3,690).

Solution $\begin{array}{r} 3{,}690 \\ \times 25 \\ \hline 18\,450 \\ 73\,80 \\ \hline 92{,}250 \end{array}$

The cost of the land is $92,250.

35. Strategy To find the temperature, add the increase (7) to the original temperature (–12).

Solution $-12+7=-5$

The temperature is –5°C.

36. Strategy To find the trade balance for services, subtract the balance for goods (–35,393 million) from the total trade balance (–28,714 million).

Solution $-28{,}714-(-35{,}393)$
$=-28{,}714+35{,}393$
$=6{,}779$

The trade balance for services is $6,779,000,000.

37. Strategy To find the amount:
→Add the sales figures for the first three quarters (28,550 + 34,850 + 31,700).
→Subtract the sum from the goal for the year (120,000).

Solution $\begin{array}{r} 28{,}550 \\ 34{,}850 \\ +31{,}700 \\ \hline 95{,}100 \end{array}$

$\begin{array}{r} 120{,}000 \\ -95{,}100 \\ \hline 24{,}900 \end{array}$

You must sell $24,900 in the last quarter to meet the goal.

38. Strategy To find the score, substitute 198 for N and 206 for P in the given formula and solve for S.

Solution $S=N-P$
$S=198-206$
$S=-8$

The golfer's score is –8.

Chapter 3

Section 3.1

Objective A Exercises, page 155

1. $4 = 2^2$
$8 = 2^3$
The LCM $= 2^3 = 8$.

2. $3 = 3$
$9 = 3^2$
The LCM $= 3^2 = 9$.

3. $2 = 2$
$7 = 7$
The LCM $= 2 \cdot 7 = 14$.

4. $5 = 5$
$11 = 11$
The LCM $= 5 \cdot 11 = 55$.

5. $6 = 2 \cdot 3$
$10 = 2 \cdot 5$
The LCM $= 2 \cdot 3 \cdot 5 = 30$.

6. $8 = 2^3$
$12 = 2^2 \cdot 3$
The LCM $= 2^3 \cdot 3 = 24$.

7. $9 = 3^2$
$15 = 3 \cdot 5$
The LCM $= 3^2 \cdot 5 = 45$.

8. $14 = 2 \cdot 7$
$21 = 3 \cdot 7$
The LCM $= 2 \cdot 3 \cdot 7 = 42$.

9. $12 = 2^2 \cdot 3$
$16 = 2^4$
The LCM $= 2^4 \cdot 3 = 48$.

10. $8 = 2^3$
$14 = 2 \cdot 7$
The LCM $= 2^3 \cdot 7 = 56$.

11. $4 = 4^2$
$10 = 2 \cdot 5$
The LCM $= 2^2 \cdot 5 = 20$.

12. $9 = 3^2$
$30 = 2 \cdot 3 \cdot 5$
The LCM $= 2 \cdot 3^2 \cdot 5 = 90$.

13. $14 = 2 \cdot 7$
$42 = 2 \cdot 3 \cdot 7$
The LCM $= 2 \cdot 3 \cdot 7 = 42$.

14. $16 = 2^4$
$48 = 2^4 \cdot 3$
The LCM $= 2^4 \cdot 3 = 48$.

15. $24 = 2^3 \cdot 3$
$36 = 2^2 \cdot 3^2$
The LCM $= 2^3 \cdot 3^2 = 72$.

16. $16 = 2^4$
$28 = 2^2 \cdot 7$
The LCM $= 2^4 \cdot 7 = 112$.

17. $30 = 2 \cdot 3 \cdot 5$
$40 = 2^3 \cdot 5$
The LCM $= 2^3 \cdot 3 \cdot 5 = 120$.

18. $45 = 3^2 \cdot 5$
$60 = 2^2 \cdot 3 \cdot 5$
The LCM $= 2^2 \cdot 3^2 \cdot 5 = 180$.

19. $3 = 3$
$5 = 5$
$10 = 2 \cdot 5$
The LCM $= 2 \cdot 3 \cdot 5 = 30$.

20. $5 = 5$
$10 = 2 \cdot 5$
$20 = 2^2 \cdot 5$
The LCM $= 2^2 \cdot 5 = 20$.

21. $4 = 2^2$
$8 = 2^3$
$12 = 2^2 \cdot 3$
The LCM $= 2^3 \cdot 3 = 24$.

22. $3 = 3$
$12 = 2^2 \cdot 3$
$18 = 2 \cdot 3^2$
The LCM $= 2^2 \cdot 3^2 = 36$.

23. $9 = 3^2$
$36 = 2^2 \cdot 3^2$
$45 = 5 \cdot 3^2$
The LCM $= 2^2 \cdot 3^2 \cdot 5 = 180$.

24. $9 = 3^2$
$36 = 2^2 \cdot 3^2$
$72 = 2^3 \cdot 3^2$
The LCM $= 2^3 \cdot 3^2 = 72$

25. $6 = 2 \cdot 3$
$9 = 3^2$
$15 = 3 \cdot 5$
The LCM $= 2 \cdot 3^2 \cdot 5 = 90$.

26. $30 = 2 \cdot 3 \cdot 5$
$40 = 2^3 \cdot 5$
$60 = 2^2 \cdot 3 \cdot 5$
The LCM $= 2^3 \cdot 3 \cdot 5 = 120$.

27. $13 = 13$
$26 = 2 \cdot 13$
$39 = 3 \cdot 13$
The LCM $= 2 \cdot 3 \cdot 13 = 78$.

28. $12 = 2^2 \cdot 3$
$48 = 2^4 \cdot 3$
$72 = 2^3 \cdot 3^2$
The LCM $2^4 \cdot 3^2 = 144$.

Objective B Exercises, pages 155–156

29. $9 = 3^2$
$12 = 2^2 \cdot 3$
The GCF = 3.

30. $6 = 2 \cdot 3$
$15 = 3 \cdot 5$
The GCF = 3.

31. $18 = 2 \cdot 3^2$
$30 = 2 \cdot 3 \cdot 5$
The GCF $= 2 \cdot 3 = 6$.

32. $15 = 3 \cdot 5$
$35 = 5 \cdot 7$
The GCF = 5.

33. $14 = 2 \cdot 7$
$42 = 2 \cdot 3 \cdot 7$
The GCF $= 2 \cdot 7 = 14$.

34. $25 = 5^2$
$50 = 2 \cdot 5^2$
The GCF $= 5^2 = 25$.

35. $16 = 2^4$
$80 = 2^4 \cdot 5$
The GCF $= 2^4 = 16$.

36. $17 = 17$
$51 = 3 \cdot 17$
The GCF = 17.

37. $21 = 3 \cdot 7$
$55 = 5 \cdot 11$
The GCF = 1.

38. $32 = 2^5$
$35 = 5 \cdot 7$
The GCF = 1.

39. $8 = 2^3$
$36 = 2^2 \cdot 3^2$
The GCF $= 2^2 = 4$.

40. $12 = 2^2 \cdot 3$
$80 = 2^4 \cdot 5$
The GCF $= 2^2 = 4$.

41. $12 = 2^2 \cdot 3$
$76 = 2^2 \cdot 19$
The GCF $= 2^2 = 4$.

42. $16 = 2^4$
$60 = 2^2 \cdot 3 \cdot 5$
The GCF $= 2^2 = 4$.

43. $24 = 2^3 \cdot 3$
$30 = 2 \cdot 3 \cdot 5$
The GCF $= 2 \cdot 3 = 6$.

44. $16 = 2^4$
$28 = 2^2 \cdot 7$
The GCF $= 2^2 = 4$.

45. $24 = 2^3 \cdot 3$
$36 = 2^2 \cdot 3^2$
The GCF $= 2^2 \cdot 3 = 12$.

46. $30 = 2 \cdot 3 \cdot 5$
$40 = 2^3 \cdot 5$
The GCF $= 2 \cdot 5 = 10$.

47. $45 = 3^2 \cdot 5$
$75 = 3 \cdot 5^2$
The GCF = $3 \cdot 5 = 15$.

48. $12 = 2^2 \cdot 3$
$54 = 2 \cdot 3^3$
The GCF = $2 \cdot 3 = 6$.

49. $6 = 2 \cdot 3$
$10 = 2 \cdot 5$
$12 = 2^2 \cdot 3$
The GCF = 2.

50. $8 = 2^3$
$12 = 2^2 \cdot 3$
$20 = 2^2 \cdot 5$
The GCF = $2^2 = 4$.

51. $6 = 2 \cdot 3$
$15 = 3 \cdot 5$
$36 = 2^2 \cdot 3^2$
The GCF = 3.

52. $15 = 3 \cdot 5$
$20 = 2^2 \cdot 5$
$30 = 2 \cdot 3 \cdot 5$
The GCF = 5.

53. $21 = 3 \cdot 7$
$63 = 3^2 \cdot 7$
$84 = 2^2 \cdot 3 \cdot 7$
The GCF = $3 \cdot 7 = 21$.

54. $12 = 2^2 \cdot 3$
$28 = 2^2 \cdot 7$
$48 = 2^4 \cdot 3$
The GCF = $2^2 = 4$.

55. $24 = 2^3 \cdot 3$
$36 = 2^2 \cdot 3^2$
$60 = 2^2 \cdot 3 \cdot 5$
The GCF = $2^2 \cdot 3 = 12$.

56. $32 = 2^5$
$56 = 2^3 \cdot 7$
$72 = 2^3 \cdot 3^2$
The GCF = $2^3 = 8$.

Objective C Exercises, page 156

57. Strategy: To find how often the machines are starting to fill a box at the same time, find the LCM of 2 and 3.

Solution: $2 = 2$
$3 = 3$
The LCM = $2 \cdot 3 = 6$.
Every 6 min, the machines will start to fill a box at the same time.

58. Strategy: To find the number of pairs to be packaged together, find the GCF of 3, 6, and 12.

Solution: $3 = 3$
$6 = 2 \cdot 3$
$12 = 2^2 \cdot 3$
The GCF = 3.
Each package should contain 3 pairs of stockings.

59. Strategy: To find the number of copies to be packaged together, find the GCF of 75, 100, and 150.

Solution: $75 = 3 \cdot 5^2$
$100 = 2^2 \cdot 5^2$
$150 = 2 \cdot 3 \cdot 5^2$
The GCF = $5^2 = 25$.
Each package should contain 25 copies of the magazine.

60. Strategy To find the amount of time for both of you to be at the starting point, find the LCM of 4 and 5. Use a model to find the number of times you will pass your friend.

Solution $4 = 2^2$
$5 = 5$
The LCM $= 2^2 \cdot 5 = 20$.
Both of you will be at the starting point in 20 min.
You will swim the length of the pool ten times ($20 \div 4 = 5$ laps). You and your friend will be a the same point at the start and at the end. Thus you will pass your friend each of the other eight lengths of the pool.
You will pass your friend 8 times.

61. Strategy To find the time when all sessions begin again at the same time.
→Add the time of the break (10 min) to the 30-minute and the 40-minute session to find the time for each session including the break.
→Find the LCM of the two sessions found in step 1.
→Add the time found in step
2 to 9:00 A.M.

Solution $30 + 10 = 40$
$40 + 10 = 50$
$40 = 2^3 \cdot 5$
$50 = 2 \cdot 5^2$
The LCM $= 2^3 \cdot 5^2 = 200$.
200 min = 3 h 20 min
9 A.M. + 3 h 20 min
= 12:20 P.M.
All sessions will start at the same time at 12:20 P.M.
Lunch should be scheduled at 12:20 P.M. if all participants are to eat at the same time.

Critical Thinking 3.1, page 156

62. x and y are prime numbers.
The prime factors of x are: x
The prime factors of y are: y
The LCM of x and y is $x \cdot y = xy$.
The GCF of x and y is 1.

63. $x = x$
$2x = 2 \cdot x$
The LCM $= 2 \cdot x = 2x$.
The GCF $= x$.

Section 3.2

Objective A Exercises, pages 165–166

1. $\frac{4}{5}$

2. $\frac{5}{8}$

3. $\frac{1}{4}$

4. $\frac{4}{7}$

5. $\frac{4}{3}, 1\frac{1}{3}$

6. $\frac{23}{8}, 2\frac{7}{8}$

7. $\frac{13}{5}, 2\frac{3}{5}$

8. $\frac{15}{4}, 3\frac{3}{4}$

9. $$\begin{array}{r} 3 \\ 4\overline{)\,13} \\ \underline{-12} \\ 1 \end{array} \qquad \frac{13}{4} = 3\frac{1}{4}$$

10. $$\begin{array}{r} 4 \\ 3\overline{)\,14} \\ \underline{-12} \\ 2 \end{array} \qquad \frac{14}{3} = 4\frac{2}{3}$$

11. $$\begin{array}{r} 4 \\ 5\overline{)\,20} \\ \underline{-20} \\ 0 \end{array} \qquad \frac{20}{5} = 4$$

12. $\begin{array}{r} 3 \\ 6\overline{)\,18} \\ \underline{-18} \\ 0 \end{array} \qquad \frac{18}{6}=3$

13. $\begin{array}{r} 2 \\ 10\overline{)\,27} \\ \underline{-20} \\ 7 \end{array} \qquad \frac{27}{10}=2\frac{7}{10}$

14. $\begin{array}{r} 10 \\ 3\overline{)\,31} \\ \underline{-3} \\ 1 \\ \underline{-0} \\ 1 \end{array} \qquad \frac{31}{3}=10\frac{1}{3}$

15. $\begin{array}{r} 7 \\ 8\overline{)\,56} \\ \underline{-56} \\ 0 \end{array} \qquad \frac{56}{8}=7$

16. $\begin{array}{r} 3 \\ 9\overline{)\,27} \\ \underline{-27} \\ 0 \end{array} \qquad \frac{27}{9}=3$

17. $\begin{array}{r} 1 \\ 9\overline{)\,17} \\ \underline{-9} \\ 8 \end{array} \qquad \frac{17}{9}=1\frac{8}{9}$

18. $\begin{array}{r} 2 \\ 3\overline{)\,8} \\ \underline{-6} \\ 2 \end{array} \qquad \frac{8}{3}=2\frac{2}{3}$

19. $\begin{array}{r} 2 \\ 5\overline{)\,12} \\ \underline{-10} \\ 2 \end{array} \qquad \frac{12}{5}=2\frac{2}{5}$

20. $\begin{array}{r} 2 \\ 8\overline{)\,19} \\ \underline{-16} \\ 3 \end{array} \qquad \frac{19}{8}=2\frac{3}{8}$

21. $\begin{array}{r} 18 \\ 1\overline{)\,18} \\ \underline{-1} \\ 8 \\ \underline{-8} \\ 0 \end{array} \qquad \frac{18}{1}=18$

22. $\begin{array}{r} 21 \\ 1\overline{)\,21} \\ \underline{-2} \\ 1 \\ \underline{-1} \\ 0 \end{array} \qquad \frac{21}{1}=21$

23. $\begin{array}{r} 2 \\ 15\overline{)\,32} \\ \underline{-30} \\ 2 \end{array} \qquad \frac{32}{15}=2\frac{2}{15}$

24. $\begin{array}{r} 2 \\ 14\overline{)\,39} \\ \underline{-28} \\ 11 \end{array} \qquad \frac{39}{14}=2\frac{11}{14}$

25. $\frac{8}{8}=1$

26. $\frac{12}{12}=1$

27. $\begin{array}{r} 9 \\ 3\overline{)\,28} \\ \underline{-27} \\ 1 \end{array} \qquad \frac{28}{3}=9\frac{1}{3}$

28. $\begin{array}{r} 8 \\ 5\overline{)\,43} \\ \underline{-40} \\ 3 \end{array} \qquad \frac{43}{5}=8\frac{3}{5}$

29. $2\frac{1}{4}=\frac{(4\cdot 2)+1}{4}=\frac{8+1}{4}=\frac{9}{4}$

30. $4\frac{2}{5}=\frac{(5\cdot 4)+2}{5}=\frac{20+2}{5}=\frac{22}{5}$

31. $5\frac{1}{2}=\frac{(2\cdot 5)+1}{2}=\frac{10+1}{2}=\frac{11}{2}$

32. $3\frac{2}{3}=\frac{(3\cdot 3)+2}{3}=\frac{9+2}{3}=\frac{11}{3}$

33. $2\frac{4}{5}=\frac{(5\cdot 2)+4}{5}=\frac{10+4}{5}=\frac{14}{5}$

34. $6\frac{3}{8}=\frac{(8\cdot 6)+3}{8}=\frac{48+3}{8}=\frac{51}{8}$

35. $7\frac{5}{6}=\frac{(6\cdot 7)+5}{6}=\frac{42+5}{6}=\frac{47}{6}$

36. $9\frac{1}{5}=\frac{(5\cdot 9)+1}{5}=\frac{45+1}{5}=\frac{46}{5}$

37. $7 = \frac{7}{1}$

38. $4 = \frac{4}{1}$

39. $8\frac{1}{4} = \frac{(4 \cdot 8)+1}{4} = \frac{32+1}{4} = \frac{33}{4}$

40. $1\frac{7}{9} = \frac{(9 \cdot 1)+7}{9} = \frac{9+7}{9} = \frac{16}{9}$

41. $10\frac{1}{3} = \frac{(3 \cdot 10)+1}{3} = \frac{30+1}{3} = \frac{31}{3}$

42. $6\frac{3}{7} = \frac{(7 \cdot 6)+3}{7} = \frac{42+3}{7} = \frac{45}{7}$

43. $4\frac{7}{12} = \frac{(12 \cdot 4)+7}{12} = \frac{48+7}{12} = \frac{55}{12}$

44. $5\frac{4}{9} = \frac{(9 \cdot 5)+4}{9} = \frac{45+4}{9} = \frac{49}{9}$

45. $8 = \frac{8}{1}$

46. $6 = \frac{6}{1}$

47. $12\frac{4}{5} = \frac{(5 \cdot 12)+4}{5} = \frac{60+4}{5} = \frac{64}{5}$

48. $11\frac{5}{8} = \frac{(8 \cdot 11)+5}{8} = \frac{88+5}{8} = \frac{93}{8}$

Objective B Exercises, pages 166–167

49. $12 \div 2 = 6$
$\frac{1}{2} = \frac{1 \cdot 6}{2 \cdot 6} = \frac{6}{12}$
$\frac{6}{12}$ is equivalent to $\frac{1}{2}$.

50. $20 \div 4 = 5$
$\frac{1}{4} = \frac{1 \cdot 5}{4 \cdot 5} = \frac{5}{20}$
$\frac{5}{20}$ is equivalent to $\frac{1}{4}$.

51. $24 \div 8 = 3$
$\frac{3}{8} = \frac{3 \cdot 3}{8 \cdot 3} = \frac{9}{24}$
$\frac{9}{24}$ is equivalent to $\frac{3}{8}$.

52. $44 \div 11 = 4$
$\frac{9}{11} = \frac{9 \cdot 4}{11 \cdot 4} = \frac{36}{44}$
$\frac{36}{44}$ is equivalent to $\frac{9}{11}$.

53. $51 \div 17 = 3$
$\frac{2}{17} = \frac{2 \cdot 3}{17 \cdot 3} = \frac{6}{51}$
$\frac{6}{51}$ is equivalent to $\frac{2}{17}$.

54. $80 \div 10 = 8$
$\frac{9}{10} = \frac{9 \cdot 8}{10 \cdot 8} = \frac{72}{80}$
$\frac{72}{80}$ is equivalent to $\frac{9}{10}$.

55. $32 \div 4 = 8$
$\frac{3}{4} = \frac{3 \cdot 8}{4 \cdot 8} = \frac{24}{32}$
$\frac{24}{32}$ is equivalent to $\frac{3}{4}$.

56. $32 \div 8 = 4$
$\frac{5}{8} = \frac{5 \cdot 4}{8 \cdot 4} = \frac{20}{32}$
$\frac{20}{32}$ is equivalent to $\frac{5}{8}$.

57. $18 \div 1 = 18$
$6 = \frac{6}{1} = \frac{6 \cdot 18}{1 \cdot 18} = \frac{108}{18}$
$\frac{108}{18}$ is equivalent to 6.

58. $35 \div 1 = 35$
$5 = \frac{5}{1} = \frac{5 \cdot 35}{1 \cdot 35} = \frac{175}{35}$
$\frac{175}{35}$ is equivalent to 5.

59. $90 \div 3 = 30$
$\frac{1}{3} = \frac{1 \cdot 30}{3 \cdot 30} = \frac{30}{90}$
$\frac{30}{90}$ is equivalent to $\frac{1}{3}$.

60. $48 \div 16 = 3$
$\frac{3}{16} = \frac{3 \cdot 3}{16 \cdot 3} = \frac{9}{48}$
$\frac{9}{48}$ is equivalent to $\frac{3}{16}$.

61. $21 \div 3 = 7$
$\frac{2}{3} = \frac{2 \cdot 7}{3 \cdot 7} = \frac{14}{21}$
$\frac{14}{21}$ is equivalent to $\frac{2}{3}$.

62. $36 \div 9 = 4$
$\frac{4}{9} = \frac{4\cdot 4}{9\cdot 4} = \frac{16}{36}$
$\frac{16}{36}$ is equivalent to $\frac{4}{9}$.

63. $49 \div 7 = 7$
$\frac{6}{7} = \frac{6\cdot 7}{7\cdot 7} = \frac{42}{49}$
$\frac{42}{49}$ is equivalent to $\frac{6}{7}$.

64. $40 \div 8 = 5$
$\frac{7}{8} = \frac{7\cdot 5}{8\cdot 5} = \frac{35}{40}$
$\frac{35}{40}$ is equivalent to $\frac{7}{8}$.

65. $18 \div 9 = 2$
$\frac{4}{9} = \frac{4\cdot 2}{9\cdot 2} = \frac{8}{18}$
$\frac{8}{18}$ is equivalent to $\frac{4}{9}$.

66. $48 \div 12 = 4$
$\frac{11}{12} = \frac{11\cdot 4}{12\cdot 4} = \frac{44}{48}$
$\frac{44}{48}$ is equivalent to $\frac{11}{12}$.

67. $4 \div 1 = 4$
$7 = \frac{7}{1} = \frac{7\cdot 4}{1\cdot 4} = \frac{28}{4}$
$\frac{28}{4}$ is equivalent to 7.

68. $6 \div 1 = 6$
$9 = \frac{9}{1} = \frac{9\cdot 6}{1\cdot 6} = \frac{54}{6}$
$\frac{54}{6}$ is equivalent to 9.

69. $\frac{3}{12} = \frac{3}{2\cdot 2\cdot 3} = \frac{1}{4}$

70. $\frac{10}{22} = \frac{2\cdot 5}{2\cdot 11} = \frac{5}{11}$

71. $\frac{33}{44} = \frac{3\cdot 11}{2\cdot 2\cdot 11} = \frac{3}{4}$

72. $\frac{6}{14} = \frac{2\cdot 3}{2\cdot 7} = \frac{3}{7}$

73. $\frac{4}{24} = \frac{2\cdot 2}{2\cdot 2\cdot 2\cdot 3} = \frac{1}{6}$

74. $\frac{25}{75} = \frac{5\cdot 5}{3\cdot 5\cdot 5} = \frac{1}{3}$

75. $\frac{8}{33} = \frac{2\cdot 2\cdot 2}{3\cdot 11} = \frac{8}{33}$

76. $\frac{9}{25} = \frac{3\cdot 3}{5\cdot 5} = \frac{9}{25}$

77. $\frac{0}{8} = 0$

78. $\frac{0}{11} = 0$

79. $\frac{42}{36} = \frac{2\cdot 3\cdot 7}{2\cdot 2\cdot 3\cdot 3} = \frac{7}{6}$

80. $\frac{30}{18} = \frac{2\cdot 3\cdot 5}{2\cdot 3\cdot 3} = \frac{5}{3}$

81. $\frac{16}{16} = 1$

82. $\frac{24}{24} = 1$

83. $\frac{21}{35} = \frac{3\cdot 7}{5\cdot 7} = \frac{3}{5}$

84. $\frac{11}{55} = \frac{11}{5\cdot 11} = \frac{1}{5}$

85. $\frac{16}{60} = \frac{2\cdot 2\cdot 2\cdot 2}{2\cdot 2\cdot 3\cdot 5} = \frac{4}{15}$

86. $\frac{8}{84} = \frac{2\cdot 2\cdot 2}{2\cdot 2\cdot 3\cdot 7} = \frac{2}{21}$

87. $\frac{12}{20} = \frac{2\cdot 2\cdot 3}{2\cdot 2\cdot 5} = \frac{3}{5}$

88. $\frac{24}{36} = \frac{2\cdot 2\cdot 2\cdot 3}{2\cdot 2\cdot 3\cdot 3} = \frac{2}{3}$

89. $\frac{12m}{18} = \frac{2\cdot \overset{1}{\cancel{2}}\cdot \overset{1}{\cancel{3}}\cdot m}{\underset{1}{\cancel{2}}\cdot \underset{1}{\cancel{3}}\cdot 3} = \frac{2m}{3}$

90. $\frac{20x}{25} = \frac{2\cdot 2\cdot \overset{1}{\cancel{5}}\cdot x}{\underset{1}{\cancel{5}}\cdot 5} = \frac{4x}{5}$

91. $\frac{4y}{8} = \frac{\overset{1}{\cancel{2}}\cdot \overset{1}{\cancel{2}}\cdot y}{\underset{1}{\cancel{2}}\cdot \underset{1}{\cancel{2}}\cdot 2} = \frac{y}{2}$

92. $\frac{14z}{28} = \frac{\overset{1}{\cancel{2}}\cdot \overset{1}{\cancel{7}}\cdot z}{\underset{1}{\cancel{2}}\cdot 2\cdot \underset{1}{\cancel{7}}} = \frac{z}{2}$

93. $\frac{24a}{36}=\frac{\overset{1}{\cancel{2}}\cdot\overset{1}{\cancel{2}}\cdot 2\cdot\overset{1}{\cancel{3}}\cdot a}{\underset{1}{\cancel{2}}\cdot\underset{1}{\cancel{2}}\cdot\underset{1}{\cancel{3}}\cdot 3}=\frac{2a}{3}$

94. $\frac{28z}{21}=\frac{2\cdot 2\cdot\overset{1}{\cancel{7}}\cdot z}{3\cdot\underset{1}{\cancel{7}}}=\frac{4z}{3}$

95. $\frac{8c}{8}=\frac{\overset{1}{\cancel{2}}\cdot\overset{1}{\cancel{2}}\cdot\overset{1}{\cancel{2}}\cdot c}{\underset{1}{\cancel{2}}\cdot\underset{1}{\cancel{2}}\cdot\underset{1}{\cancel{2}}}=c$

96. $\frac{9w}{9}=\frac{\overset{1}{\cancel{3}}\cdot\overset{1}{\cancel{3}}\cdot w}{\underset{1}{\cancel{3}}\cdot\underset{1}{\cancel{3}}}=w$

97. $\frac{18k}{3}=\frac{2\cdot 3\cdot\overset{1}{\cancel{3}}\cdot k}{\underset{1}{\cancel{3}}}=6k$

98. $\frac{24t}{4}=\frac{\overset{1}{\cancel{2}}\cdot\overset{1}{\cancel{2}}\cdot 2\cdot 3\cdot t}{\underset{1}{\cancel{2}}\cdot\underset{1}{\cancel{2}}}=6t$

Objective C Exercises, page 167

99. $\frac{3}{8}=\frac{15}{40}$ $\quad\frac{2}{5}=\frac{16}{40}$
$\frac{15}{40}<\frac{16}{40}$
$\frac{3}{8}<\frac{2}{5}$

100. $\frac{5}{7}=\frac{15}{21}$ $\quad\frac{2}{3}=\frac{14}{21}$
$\frac{15}{21}>\frac{14}{21}$
$\frac{5}{7}>\frac{2}{3}$

101. $\frac{3}{4}=\frac{27}{36}$ $\quad\frac{7}{9}=\frac{28}{36}$
$\frac{27}{36}<\frac{28}{36}$
$\frac{3}{4}<\frac{7}{9}$

102. $\frac{7}{12}=\frac{14}{24}$ $\quad\frac{5}{8}=\frac{15}{24}$
$\frac{14}{24}<\frac{15}{24}$
$\frac{7}{12}<\frac{5}{8}$

103. $\frac{2}{3}=\frac{22}{33}$ $\quad\frac{7}{11}=\frac{21}{33}$
$\frac{22}{33}>\frac{21}{33}$
$\frac{2}{3}>\frac{7}{11}$

104. $\frac{11}{14}=\frac{22}{28}$ $\quad\frac{3}{4}=\frac{21}{28}$
$\frac{22}{28}>\frac{21}{28}$
$\frac{11}{14}>\frac{3}{4}$

105. $\frac{17}{24}=\frac{34}{48}$ $\quad\frac{11}{16}=\frac{33}{48}$
$\frac{34}{48}>\frac{33}{48}$
$\frac{17}{24}>\frac{11}{16}$

106. $\frac{11}{12}=\frac{33}{36}$ $\quad\frac{7}{9}=\frac{28}{36}$
$\frac{33}{36}>\frac{28}{36}$
$\frac{11}{12}>\frac{7}{9}$

107. $\frac{7}{15}=\frac{28}{60}$ $\quad\frac{5}{12}=\frac{25}{60}$
$\frac{28}{60}>\frac{25}{60}$
$\frac{7}{15}>\frac{5}{12}$

108. $\frac{5}{8}=\frac{35}{56}$ $\quad\frac{4}{7}=\frac{32}{56}$
$\frac{35}{56}>\frac{32}{56}$
$\frac{5}{8}>\frac{4}{7}$

109. $\frac{5}{9}=\frac{35}{63}$ $\quad\frac{11}{21}=\frac{33}{63}$
$\frac{35}{63}>\frac{33}{63}$
$\frac{5}{9}>\frac{11}{21}$

110. $\frac{11}{30}=\frac{44}{120}$ $\quad\frac{7}{24}=\frac{35}{120}$
$\frac{44}{120}>\frac{35}{120}$
$\frac{11}{30}>\frac{7}{24}$

111. $\frac{7}{12}=\frac{21}{36}$ $\frac{13}{18}=\frac{26}{36}$
$\frac{21}{36}<\frac{26}{36}$
$\frac{7}{12}<\frac{13}{18}$

112. $\frac{9}{11}=\frac{72}{88}$ $\frac{7}{8}=\frac{77}{88}$
$\frac{72}{88}<\frac{77}{88}$
$\frac{9}{11}<\frac{7}{8}$

113. $\frac{4}{5}=\frac{36}{45}$ $\frac{7}{9}=\frac{35}{45}$
$\frac{36}{45}>\frac{35}{45}$
$\frac{4}{5}>\frac{7}{9}$

114. $\frac{3}{4}=\frac{39}{52}$ $\frac{11}{13}=\frac{44}{52}$
$\frac{39}{52}<\frac{44}{52}$
$\frac{3}{4}<\frac{11}{13}$

115. $\frac{9}{16}=\frac{81}{144}$ $\frac{5}{9}=\frac{80}{144}$
$\frac{81}{144}>\frac{80}{144}$
$\frac{9}{16}>\frac{5}{9}$

116. $\frac{2}{3}=\frac{20}{30}$ $\frac{7}{10}=\frac{21}{30}$
$\frac{20}{30}<\frac{21}{30}$
$\frac{2}{3}<\frac{7}{10}$

117. $\frac{5}{8}=\frac{50}{80}$ $\frac{13}{20}=\frac{52}{80}$
$\frac{50}{80}<\frac{52}{80}$
$\frac{5}{8}<\frac{13}{20}$

118. $\frac{3}{10}=\frac{15}{50}$ $\frac{7}{25}=\frac{14}{50}$
$\frac{15}{50}>\frac{14}{50}$
$\frac{3}{10}>\frac{7}{25}$

Objective D Exercises, pages 168–169

119. Strategy To find the fractions, write a fraction with 250 in the numerator and 2,000 in the denominator. Write the fraction in simplest form.

Solution $\frac{250}{2{,}000}=\frac{2\cdot5\cdot5\cdot5}{2\cdot2\cdot2\cdot2\cdot5\cdot5\cdot5}=\frac{1}{8}$

250 lb is $\frac{1}{8}$ of a ton.

120. Strategy To find the fractions, write a fraction with 6 in the numerator and 16 in the denominator. Write the fraction in simplest form.

Solution $\frac{6}{16}=\frac{2\cdot3}{2\cdot2\cdot2\cdot2}=\frac{3}{8}$

6 oz is $\frac{3}{8}$ of a pound.

121. Strategy To find the fractions, write a fraction with 50 in the numerator and 60 in the denominator. Write the fraction in simplest form.

Solution $\frac{50}{60}=\frac{2\cdot5\cdot5}{2\cdot2\cdot3\cdot5}=\frac{5}{6}$

The history class is $\frac{5}{6}$ of an hour.

122. Strategy To find the fraction, write a fraction with 8 in the numerator and the number of hours in one day (24) in the denominator. Write the fraction in simplest form.

Solution $\frac{8}{24}=\frac{2\cdot2\cdot2}{2\cdot2\cdot2\cdot3}=\frac{1}{3}$

8 h is $\frac{1}{3}$ of a day.

123. Strategy To find the fractions, write a fraction with 18 in the numerator and 24 in the denominator. Write the fraction in simplest form.

Solution $\frac{18}{24} = \frac{2\cdot 3\cdot 3}{2\cdot 2\cdot 2\cdot 3} = \frac{3}{4}$

18 karate gold is $\frac{3}{4}$ pure gold.

124. Strategy To find which service is more important,

→Rewrite the food quality fraction $\frac{1}{4}$ as a fraction with a denominator of 100.

→Rewrite location fraction $\frac{13}{50}$ as a fraction with a denominator of 100.

→Compare the two fractions.

Solution

$$\frac{1}{4} = \frac{1\cdot 25}{4\cdot 25} = \frac{25}{100}$$

$$\frac{13}{50} = \frac{13\cdot 2}{50\cdot 2} = \frac{26}{100}$$

$$\frac{26}{100} > \frac{25}{100}$$

The location was more important than the food quality.

125. Strategy To find which criterion was cited by most people,

→Rewrite each fraction as a fraction with a denominator of 100.

→Compare all the fractions.

Solution

$$\frac{1}{4} = \frac{1\cdot 25}{4\cdot 25} = \frac{25}{100}$$

$$\frac{13}{50} = \frac{13\cdot 2}{50\cdot 2} = \frac{26}{100}$$

$$\frac{4}{25} = \frac{4\cdot 4}{25\cdot 4} = \frac{16}{100}$$

$$\frac{2}{25} = \frac{2\cdot 4}{25\cdot 4} = \frac{8}{100}$$

$$\frac{3}{25} = \frac{3\cdot 4}{25\cdot 4} = \frac{12}{100}$$

$$\frac{26}{100} > \frac{25}{100} > \frac{16}{100} > \frac{12}{100} > \frac{8}{100} > \frac{3}{100}$$

The location was the most cited criterion.

126. Strategy

a. To find the fraction, write a fraction with the number of spades (13) in the numerator and the total number of cards (52) in the denominator. Write the fraction in simplest form.

b. To find the fraction, write a fraction with the number of aces (4) in the numerator and the total number of cards (52) in the denominator. Write the fraction simplest form.

Solution

a. $\frac{13}{52} = \frac{13}{4 \cdot 13} = \frac{1}{4}$

Spades are $\frac{1}{4}$ of a standard deck of cards.

b. $\frac{4}{52} = \frac{2 \cdot 2}{2 \cdot 2 \cdot 13} = \frac{1}{13}$

Aces are $\frac{1}{13}$ of a standard deck of cards.

127. Strategy To determine if you answered more or less than $\frac{8}{10}$ of the questions correctly:

→Write a fraction with the number of questions answered correctly (42) in the numerator and the total number of questions (50) in the denominator.

→Rewrite $\frac{8}{10}$ as a fraction with a denominator of 50.

→Compare the two fractions.

Solution $\frac{42}{50}$

$\frac{8}{10} = \frac{8 \cdot 5}{10 \cdot 5} = \frac{40}{50}$

$\frac{42}{50} > \frac{40}{50}$

You answered more than $\frac{8}{10}$ of the questions correctly.

128. Strategy To determine if you will pass the exam:

→Write a fraction with the number of questions answered correctly (150) in the numerator and the total number of questions (200) in the denominator.

→Rewrite $\frac{7}{10}$ as a fraction with the denominator of 200.

→Compare the two fractions.

Solution $\frac{150}{200}$

$\frac{7}{10} = \frac{7 \cdot 20}{10 \cdot 20} = \frac{140}{200}$

$\frac{150}{200} > \frac{140}{200}$

You will pass the exam.

129. Strategy To find which is a more serious problem,

→Rewrite the job market fraction $\frac{9}{25}$ as a fraction with a denominator of 100.

→Rewrite the quality of their children's education fraction $\frac{7}{20}$ as a fraction with a denominator of 100.

→Compare the two fractions.

Solution

$$\frac{9}{25}=\frac{9\cdot 4}{25\cdot 4}=\frac{36}{100}$$

$$\frac{7}{20}=\frac{7\cdot 5}{20\cdot 5}=\frac{35}{100}$$

$$\frac{36}{100}>\frac{35}{100}$$

The job market was a more serious problem than the quality of their children's education.

130. Strategy To find which is a more serious problem,

→Rewrite the having enough time to spend with family fraction $\frac{23}{50}$ as a fraction with a denominator of 50.

→Rewrite the staying in good health fraction $\frac{2}{5}$ as a fraction with a denominator of 50.

→Compare the two fractions.

Solution

$$\frac{23}{50}$$

$$\frac{2}{5}=\frac{2\cdot 10}{5\cdot 10}=\frac{20}{50}$$

$$\frac{23}{50}>\frac{20}{50}$$

Having enough time to spend with family was a more serious problem than staying in good health.

131. Strategy To find which concern was cited by most people,
→Rewrite each fraction as a fraction with a denominator of 100.
→Compare all the fractions.

Solution

$$\frac{9}{25}=\frac{9\cdot 4}{25\cdot 4}=\frac{36}{100}$$
$$\frac{13}{50}=\frac{13\cdot 2}{50\cdot 2}=\frac{26}{100}$$
$$\frac{1}{2}=\frac{1\cdot 50}{2\cdot 50}=\frac{50}{100}$$
$$\frac{23}{50}=\frac{23\cdot 2}{50\cdot 2}=\frac{46}{100}$$
$$\frac{9}{25}=\frac{9\cdot 4}{25\cdot 4}=\frac{36}{100}$$
$$\frac{7}{20}=\frac{7\cdot 5}{20\cdot 5}=\frac{35}{100}$$
$$\frac{2}{5}=\frac{2\cdot 20}{5\cdot 20}=\frac{40}{100}$$
$$\frac{50}{100}>\frac{46}{100}>\frac{40}{100}>\frac{36}{100}=\frac{36}{100}>\frac{35}{100}>\frac{26}{100}>\frac{21}{100}$$

Having enough money to pay bills was the most cited serious problem.

132. Strategy To determine the fraction:
→Find the number of attempts he did not have a field goal by subtracting the number of field goals (36) from the number of attempts (63).
→Write a fraction with the number of attempts he did not have a field goal in the numerator and the number of attempts in the denominator. Write the fraction in simplest form.

Solution $63-36=27$

$$\frac{27}{63}=\frac{3\cdot 3\cdot 3}{3\cdot 3\cdot 7}=\frac{3}{7}$$

$\frac{3}{7}$ of his attempts did not result in a field goal.

133. Strategy To determine the fraction:
→Find the total production by the six states by adding the amount produced in Maine (175), Michigan (75), New York (200), Ohio (100), Vermont (375), and Wisconsin (75).
→Write a fraction with the production in New York (200) in the numerator and total production in the denominator. Write the fraction in simplest form.

Solution $175+75+200+100+375+75=1000$

$$\frac{200}{1000}=\frac{5\cdot 5\cdot 2\cdot 2\cdot 2}{5\cdot 5\cdot 5\cdot 2\cdot 2\cdot 2}=\frac{1}{5}$$

$\frac{1}{5}$ of the maple syrup produced was in New York.

134. Strategy To determine the fraction:
→Find the total production by the six states by adding the amount produced in Maine (175), Michigan (75), New York (200), Ohio (100), Vermont (375), and Wisconsin (75).
→Write a fraction with the sum of the production in Wisconsin (75) and Michigan (75) in the numerator and the total production in the denominator. Write the fraction in simplest form.

Solution $175 + 75 + 200 + 100 + 375 + 75 = 1000$
$75 + 75 = 150$
$$\frac{150}{1000} = \frac{5 \cdot 5 \cdot 3 \cdot 2}{5 \cdot 5 \cdot 5 \cdot 2 \cdot 2 \cdot 2} = \frac{3}{20}$$
$\frac{3}{20}$ of the maple syrup produced was in Wisconsin and Michigan.

135. Strategy
a. To determine the fraction:
→Find the total of the monthly expenses.
→Write a fraction with the amount spent on entertainment in the numerator and the total of the monthly expenses in the denominator. Write the fraction in simplest form.

b. To determine the fraction:
→Find the total of the monthly expenses.
→Write the fraction with the amount spent on taxes in the numerator and the total of the monthly expenses in the denominator. Write the fraction in simplest form.

Solution
a. $325 + 150 + 100 + 700 + 550 + 175 = 2{,}000$
$$\frac{150}{2{,}000} = \frac{2 \cdot 3 \cdot 5 \cdot 5}{2 \cdot 2 \cdot 2 \cdot 2 \cdot 5 \cdot 5 \cdot 5} = \frac{3}{40}$$
$\frac{3}{40}$ of the total monthly expenses was spent on entertainment.
b. $325 + 150 + 100 + 700 + 550 + 175 = 2{,}000$
$$\frac{175}{2{,}000} = \frac{5 \cdot 5 \cdot 7}{2 \cdot 2 \cdot 2 \cdot 2 \cdot 5 \cdot 5 \cdot 5} = \frac{7}{80}$$
$\frac{7}{80}$ of the total monthly expenses was spent on taxes.

Critical Thinking 3.2, page 170

136. Substitute $\frac{3}{8}$ for x in the given inequality.

$x < \frac{4}{9}$

$\frac{3}{8} < \frac{4}{9}$ Build the fractions to a common denominator.

$\frac{27}{72} < \frac{32}{72}$ Compare the numerators $27 < 32$.

The expression is true when $\frac{3}{8}$ is substituted for x in the inequality.

Substitute $\frac{5}{12}$ for x in the given inequality.

$x < \frac{4}{9}$

$\frac{5}{12} < \frac{4}{9}$ Build the fractions to a common denominator.

$\frac{15}{36} < \frac{16}{36}$ Compare the numerators $15 < 16$.

The expression is true when $\frac{5}{12}$ is substituted for x in the inequality.

Since any negative number is less than $\frac{4}{9}$, $x < \frac{4}{9}$ is true for any negative number.

137. The number of squares crossed by the diagonal for m rows of n squares is $m + (n - 1)$.

138. Strategy To determine the fraction:

→Find the number of states in the United States that begin with the letter A.

→Write a fraction with the number of states in U.S. that begin with the letter A in the numerator and the total number of states in the U.S. (50) in the denominator. Write the fraction in simplest form.

Solution There are 4 states that begin with the letter A: Alabama, Alaska, Arizona, Arkansas.

$\frac{4}{50} = \frac{2 \cdot 2}{2 \cdot 5 \cdot 5} = \frac{2}{25}$

$\frac{2}{25}$ of the states in the U.S. begin with the letter A.

139. a. Sales in the Northeast in 1996: $\frac{1}{3}$

Sales in the Northeast in 1997: $\frac{3}{10}$

$\frac{1}{3}=\frac{1\cdot 10}{3\cdot 10}=\frac{10}{30}\quad \frac{3}{10}=\frac{3\cdot 3}{10\cdot 3}=\frac{9}{30}$

$\frac{10}{30}>\frac{9}{30}$

$\frac{1}{3}>\frac{3}{10}$

Sales in the Northeast were a greater fraction of total sales in 1996.

b. Sales in the Northwest in 1996: $\frac{1}{6}$

Sales in the Northwest in 1997: $\frac{1}{5}$

$\frac{1}{6}=\frac{1\cdot 5}{6\cdot 5}=\frac{5}{30}\qquad \frac{1}{5}=\frac{1\cdot 6}{5\cdot 6}=\frac{6}{30}$

$\frac{6}{30}>\frac{5}{30}$

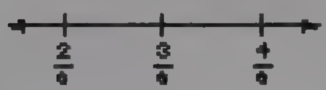
$\frac{1}{5}>\frac{1}{6}$

Sales in the Northwest were a greater fraction of total sales in 1997.

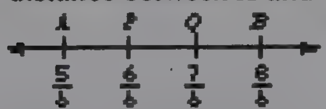
140. a. The midpoint or halfway point between $\frac{2}{a}$ and $\frac{4}{a}$ is one-half the sum of $\frac{2}{a}+\frac{4}{a}$.

$\frac{1}{2}\left(\frac{2}{a}+\frac{4}{a}\right)=\frac{1}{2}\left(\frac{6}{a}\right)=\frac{3}{a}$

The diagram below also indicates that the midpoint is $\frac{3}{a}$.



b. The diagram below shows p and q evenly spaced between A and B. The point p is $\frac{1}{3}$ of the distance between A and B.



$\frac{1}{3}\left(\frac{8}{b}-\frac{5}{b}\right)=\frac{1}{3}\left(\frac{3}{b}\right)=\frac{1}{b}$

Add $\frac{1}{b}$ to $\frac{5}{b}$ to find p. $\frac{1}{b}+\frac{5}{b}=\frac{6}{b}$

Add $\frac{1}{b}$ to $\frac{6}{b}$ to find q. $\frac{1}{b}+\frac{6}{b}=\frac{7}{b}$

Thus the two fractions $\frac{6}{b}$ and $\frac{7}{b}$ are evenly spaced between $\frac{5}{b}$ and $\frac{8}{b}$.

Section 3.3

Objective A Exercises, pages 181–183

1. $\frac{4}{11}=\frac{5}{11}=\frac{4+5}{11}$
$=\frac{9}{11}$

2. $\frac{3}{7}+\frac{2}{7}=\frac{3+2}{7}$
$=\frac{5}{7}$

3. $\frac{2}{3}+\frac{1}{3}=\frac{2+1}{3}$
$=\frac{3}{3}=1$

4. $\frac{1}{2}+\frac{1}{2}=\frac{1+1}{2}$
$=\frac{2}{2}=1$

5. $\frac{5}{6}+\frac{5}{6}=\frac{5+5}{6}$
$=\frac{10}{6}=\frac{5}{3}=1\frac{2}{3}$

6. $\frac{3}{8}+\frac{7}{8}=\frac{3+7}{8}$
$=\frac{10}{8}=\frac{5}{4}=1\frac{1}{4}$

7. $\frac{7}{13}+\frac{13}{18}+\frac{1}{18}=\frac{7+13+1}{18}$
$=\frac{21}{18}=\frac{7}{6}=1\frac{1}{6}$

8. $\frac{8}{15}+\frac{2}{15}+\frac{11}{15}=\frac{8+2+11}{15}$
$=\frac{21}{15}=\frac{7}{5}=1\frac{2}{5}$

9. $\frac{7}{b}+\frac{9}{b}=\frac{7+9}{b}$
$=\frac{16}{b}$

10. $\frac{3}{y}+\frac{6}{y}=\frac{3+6}{y}$
$=\frac{9}{y}$

11. $\frac{5}{c}+\frac{4}{c}=\frac{5+4}{c}$
$=\frac{9}{c}$

12. $\frac{2}{a}+\frac{8}{a}=\frac{2+8}{a}$
$=\frac{10}{a}$

13. $\frac{1}{x}+\frac{4}{x}+\frac{6}{x}=\frac{1+4+6}{x}$
$=\frac{11}{x}$

14. $\frac{8}{n}+\frac{5}{n}+\frac{3}{n}=\frac{8+5+3}{n}$
$=\frac{16}{n}$

15. $\frac{1}{4}+\frac{2}{3}=\frac{3}{12}+\frac{8}{12}$
$=\frac{3+8}{12}=\frac{11}{12}$

16. $\frac{2}{3}+\frac{1}{2}=\frac{4}{6}+\frac{3}{6}$
$=\frac{4+3}{6}=\frac{7}{6}=1\frac{1}{6}$

17. $\frac{7}{15}+\frac{9}{20}=\frac{28}{60}+\frac{27}{60}$
$=\frac{28+27}{60}=\frac{55}{60}=\frac{11}{12}$

18. $\frac{4}{9}+\frac{1}{6}=\frac{8}{18}+\frac{3}{18}$
$=\frac{8+3}{18}=\frac{11}{18}$

19. $\frac{2}{3}+\frac{1}{12}+\frac{5}{6}=\frac{8}{12}+\frac{1}{12}+\frac{10}{12}$
$=\frac{8+1+10}{12}$
$=\frac{19}{12}=1\frac{7}{12}$

20. $\frac{3}{8}+\frac{1}{2}+\frac{5}{12}=\frac{9}{24}+\frac{12}{24}+\frac{10}{24}$
$=\frac{9+12+10}{24}$
$=\frac{31}{24}=1\frac{7}{24}$

21. $\frac{7}{12}+\frac{3}{4}+\frac{4}{5}=\frac{35}{60}+\frac{45}{60}+\frac{48}{60}$
$=\frac{35+45+48}{60}$
$=\frac{128}{60}=\frac{32}{15}=2\frac{2}{15}$

22. $\frac{7}{11}+\frac{1}{2}+\frac{5}{6}=\frac{42}{66}+\frac{33}{66}+\frac{55}{66}$
$=\frac{42+33+55}{66}$
$=\frac{130}{66}=\frac{65}{33}=1\frac{32}{33}$

23. $-\frac{3}{4}+\frac{2}{3}=\frac{-3}{4}+\frac{2}{3}$
$=\frac{-9}{12}+\frac{8}{12}$
$=\frac{-9+8}{12}=\frac{-1}{12}=-\frac{1}{12}$

24. $-\frac{7}{12}+\frac{5}{8}=\frac{-7}{12}+\frac{5}{8}$
$=\frac{-14}{24}+\frac{15}{24}$
$=\frac{-14+15}{24}=\frac{1}{24}$

25. $\frac{2}{5}+\left(-\frac{11}{15}\right)=\frac{2}{5}+\frac{-11}{15}$
$=\frac{6}{15}+\frac{-11}{15}$
$=\frac{6+(-11)}{15}=\frac{-5}{15}=-\frac{1}{3}$

26. $\frac{1}{4}+\left(-\frac{1}{7}\right)=\frac{1}{4}+\frac{-1}{7}$
$=\frac{7}{28}+\frac{-4}{28}$
$=\frac{7+(-4)}{28}=\frac{3}{28}$

27. $\frac{3}{8}+\left(-\frac{1}{2}\right)+\frac{7}{12}=\frac{3}{8}+\frac{-1}{2}+\frac{7}{12}$
$=\frac{9}{24}+\frac{-12}{24}+\frac{14}{24}$
$=\frac{9+(-12)+14}{24}$
$=\frac{11}{24}$

28. $-\frac{7}{12}+\frac{2}{3}+\left(-\frac{4}{5}\right)=\frac{-7}{12}+\frac{2}{3}+\frac{-4}{5}$
$=\frac{-35}{60}+\frac{40}{60}+\frac{-48}{60}$
$=\frac{-35+40+(-48)}{60}$
$=\frac{-43}{60}=-\frac{43}{60}$

29. $\frac{2}{3}+\left(-\frac{5}{6}\right)+\frac{1}{4}=\frac{2}{3}+\frac{-5}{6}+\frac{1}{4}$
$=\frac{16}{24}+\frac{-20}{24}+\frac{6}{24}$
$=\frac{16+(-20)+6}{24}$
$=\frac{2}{24}=\frac{1}{12}$

30. $-\frac{5}{8}+\frac{3}{4}+\frac{1}{2}=\frac{-5}{8}+\frac{3}{4}+\frac{1}{2}$
$=\frac{-5}{8}+\frac{6}{8}+\frac{4}{8}$
$=\frac{-5+6+4}{8}$
$=\frac{5}{8}$

31. $8+7\frac{2}{3}=15\frac{2}{3}$

32. $6+9\frac{3}{5}=15\frac{3}{5}$

33. $2\frac{1}{6}+3\frac{1}{2}=2\frac{1}{6}+3\frac{3}{6}$
$=5\frac{4}{6}=5\frac{2}{3}$

34. $1\frac{3}{10}+4\frac{3}{5}=1\frac{3}{10}+4\frac{6}{10}$
$=5\frac{9}{10}$

35. $8\frac{3}{5}+6\frac{9}{20}=8\frac{12}{20}+6\frac{9}{20}$
$=14\frac{21}{20}=15\frac{1}{20}$

36. $7\frac{5}{12}+3\frac{7}{9}=7\frac{15}{36}+3\frac{28}{36}$
$=10\frac{43}{36}=11\frac{7}{36}$

37. $5\frac{5}{12}+4\frac{7}{9}=5\frac{15}{36}+4\frac{28}{36}$
$=9\frac{43}{36}=10\frac{7}{36}$

38. $2\frac{11}{12}+3\frac{7}{15}=2\frac{55}{60}+3\frac{28}{60}$
$=5\frac{83}{60}=6\frac{23}{60}$

39. $2\frac{1}{4}+3\frac{1}{2}+1\frac{2}{3}$
$=2\frac{3}{12}+3\frac{6}{12}+1\frac{8}{12}$
$=6\frac{17}{12}=7\frac{5}{12}$

40. $1\frac{2}{3}+2\frac{5}{6}+4\frac{7}{9}$
$=1\frac{12}{18}+2\frac{15}{18}+4\frac{14}{18}$
$=7\frac{41}{18}=9\frac{5}{18}$

41. $-\frac{5}{6}+\frac{4}{9}=\frac{-5}{6}+\frac{4}{9}$
$=\frac{-15}{18}+\frac{8}{18}$
$=\frac{-15+8}{18}=\frac{-7}{18}=-\frac{7}{18}$

42. $\frac{7}{12}+\left(-\frac{11}{16}\right)=\frac{7}{12}+\frac{-11}{16}$
$=\frac{28}{48}+\frac{-33}{48}$
$=\frac{28+(-33)}{48}$
$=\frac{-5}{48}=-\frac{5}{48}$

43. $\frac{2}{7}+\frac{3}{14}+\frac{1}{4}=\frac{8}{28}+\frac{6}{28}+\frac{7}{28}$
$=\frac{8+6+7}{28}$
$=\frac{21}{28}=\frac{3}{4}$

44. $\frac{1}{3}+\frac{5}{18}+\frac{2}{9}=\frac{6}{18}+\frac{5}{18}+\frac{4}{18}$
$=\frac{6+5+4}{18}$
$\frac{15}{18}=\frac{5}{6}$

45. $-\frac{5}{6}+\left(-\frac{2}{3}\right)=\frac{-5}{6}+\frac{-2}{3}$
$=\frac{-5}{6}+\frac{-4}{6}$
$=\frac{-5+(-4)}{6}=\frac{-9}{6}$
$=-\frac{3}{2}=-1\frac{1}{2}$

46. $-\frac{7}{12}+\left(-\frac{5}{9}\right)=\frac{-7}{12}+\frac{-5}{9}$
$=\frac{-21}{36}+\frac{-20}{36}$
$=\frac{-21+(-20)}{36}$
$=\frac{-41}{36}=-1\frac{5}{36}$

47. $3\frac{7}{12}+2\frac{5}{8}=3\frac{14}{24}+2\frac{15}{24}$
$=5\frac{29}{24}=6\frac{5}{24}$

48. $5\frac{4}{9}+6\frac{5}{6}=5\frac{8}{18}+6\frac{15}{18}$
$=11\frac{23}{18}=12\frac{5}{18}$

49. $\frac{7}{8}+1\frac{1}{3}=\frac{21}{24}+1\frac{8}{24}$
$=1\frac{29}{24}=2\frac{5}{24}$

50. $7\frac{11}{15}+2\frac{7}{10}+5\frac{2}{5}$
$=7\frac{22}{30}+2\frac{21}{30}+5\frac{12}{30}$
$=14\frac{55}{30}=14\frac{11}{6}=15\frac{5}{6}$

51. $x+y$
$\frac{3}{5}+\frac{4}{5}=\frac{3+4}{5}$
$=\frac{7}{5}=1\frac{2}{5}$

52. $x+y$
$\frac{5}{8}+\frac{3}{8}=\frac{5+3}{8}=\frac{8}{8}=1$

53. $x+y$
$\frac{2}{3}+\left(-\frac{3}{4}\right)=\frac{2}{3}+\frac{-3}{4}$
$=\frac{8}{12}+\frac{-9}{12}$
$=\frac{8+(-9)}{12}=\frac{-1}{12}=-\frac{1}{12}$

54. $x+y$
$-\frac{3}{8}+\frac{2}{9}=\frac{-3}{8}+\frac{2}{9}$
$=\frac{-27}{72}+\frac{16}{72}$
$=\frac{-27+16}{72}=\frac{-11}{72}=-\frac{11}{72}$

55. $x+y$
$\frac{5}{6}+\frac{8}{9}=\frac{15}{18}+\frac{16}{18}$
$=\frac{15+16}{18}=\frac{31}{18}=1\frac{13}{18}$

56. $x+y$
$\frac{3}{10}+\left(-\frac{7}{15}\right)=\frac{3}{10}+\frac{-7}{15}$
$=\frac{9}{30}+\frac{-14}{30}$
$=\frac{9+(-14)}{30}=\frac{-5}{30}=-\frac{1}{6}$

57. $x+y$

$$-\frac{5}{8}+\left(-\frac{1}{6}\right)=\frac{-5}{8}+\frac{-1}{6}$$
$$=\frac{-15}{24}+\frac{-4}{24}$$
$$=\frac{-15+(-4)}{24}$$
$$=\frac{-19}{24}=-\frac{19}{24}$$

58. $x+y$

$$-\frac{3}{8}+\left(-\frac{5}{6}\right)=\frac{-3}{8}+\frac{-5}{6}$$
$$=\frac{-9}{24}+\frac{-20}{24}$$
$$=\frac{-9+(-20)}{24}$$
$$=\frac{-29}{24}=-1\frac{5}{24}$$

59. $x+y+z$

$$\frac{3}{8}+\frac{1}{4}+\frac{7}{12}=\frac{9}{24}+\frac{6}{24}+\frac{14}{24}$$
$$=\frac{9+6+14}{24}$$
$$=\frac{29}{24}=1\frac{5}{24}$$

60. $x+y+z$

$$\frac{5}{6}+\frac{2}{3}+\frac{7}{24}=\frac{20}{24}+\frac{16}{24}+\frac{7}{24}$$
$$=\frac{20+16+7}{24}$$
$$=\frac{43}{24}=1\frac{19}{24}$$

61. $x+y+z$

$$1\frac{1}{2}+3\frac{3}{4}+6\frac{5}{12}=1\frac{6}{12}+3\frac{9}{12}+6\frac{5}{12}$$
$$=10\frac{20}{12}=10\frac{5}{3}=11\frac{2}{3}$$

62. $x+y+z$

$$7\frac{2}{3}+2\frac{5}{6}+5\frac{4}{9}=7\frac{12}{18}+2\frac{15}{18}+5\frac{8}{18}$$
$$=14\frac{35}{18}=15\frac{17}{18}$$

63. $x+y+z$

$$4\frac{3}{5}+8\frac{7}{10}+1\frac{9}{20}$$
$$=4\frac{12}{20}+8\frac{14}{20}+1\frac{9}{20}$$
$$=13\frac{35}{20}=13\frac{7}{4}=14\frac{3}{4}$$

64. $x+y+z$

$$2\frac{3}{14}+5\frac{5}{7}+3\frac{1}{2}=2\frac{3}{14}+5\frac{10}{14}+3\frac{7}{14}$$
$$=10\frac{20}{14}=10\frac{10}{7}=11\frac{3}{7}$$

65. $x+\frac{1}{4}=-\frac{7}{20}$

$$\begin{array}{r|l}
-\frac{3}{5}+\frac{1}{4} & -\frac{7}{20} \\
-\frac{12}{20}+\frac{5}{20} & -\frac{7}{20} \\
\frac{-12+5}{20} & -\frac{7}{20} \\
-\frac{7}{20} & = -\frac{7}{20}
\end{array}$$

Yes, $-\frac{3}{5}$ is a solution of the equation.

66. $\frac{3}{4}=t+\frac{3}{8}$

$$\begin{array}{r|l}
\frac{3}{4} & \frac{3}{8}+\frac{3}{8} \\
\frac{3}{4} & \frac{3+3}{8} \\
\frac{3}{4} & \frac{6}{8} \\
\frac{3}{4} & = \frac{3}{4}
\end{array}$$

Yes, $\frac{3}{8}$ is a solution of the equation.

67. $\frac{1}{4}+x=-\frac{7}{12}$

$$\begin{array}{r|l}
\frac{1}{4}+\left(-\frac{5}{6}\right) & -\frac{7}{12} \\
\frac{3}{12}+\left(-\frac{10}{12}\right) & -\frac{7}{12} \\
\frac{3+(-10)}{12} & -\frac{7}{12} \\
-\frac{7}{12} & = -\frac{7}{12}
\end{array}$$

Yes, $-\frac{5}{6}$ is a solution of the equation.

68. $0=q+\frac{4}{5}$

$$\begin{array}{r|l}
0 & -\frac{4}{5}+\frac{4}{5} \\
0 & \frac{-4+4}{5} \\
0 & \frac{0}{5} \\
0 & = 0
\end{array}$$

Yes, $-\frac{4}{5}$ is a solution of the equation.

69. $\frac{2}{5}+\frac{1}{10}=\frac{4}{10}+\frac{1}{10}=\frac{5}{10}=\frac{1}{2}$

$\frac{1}{2}$ of all veterans are veterans of the Vietnam War or Persian Gulf War.

70. $\frac{3}{10}+\frac{1}{5}=\frac{3}{10}+\frac{2}{10}=\frac{5}{10}=\frac{1}{2}$

$\frac{1}{2}$ of all veterans are veterans of World War II or the Korean War.

Objective B Exercises, pages 183–186

71. $\frac{7}{12}-\frac{5}{12}=\frac{7-5}{12}=\frac{2}{12}=\frac{1}{6}$

72. $\frac{17}{20}-\frac{9}{20}=\frac{17-9}{20}=\frac{8}{20}=\frac{2}{5}$

73. $\frac{11}{24}-\frac{7}{24}=\frac{11-7}{24}=\frac{4}{24}=\frac{1}{6}$

74. $\frac{39}{48}-\frac{23}{48}=\frac{39-23}{48}=\frac{16}{48}=\frac{1}{3}$

75. $\frac{8}{d}-\frac{3}{d}=\frac{8-3}{d}=\frac{5}{d}$

76. $\frac{12}{y}-\frac{7}{y}=\frac{12-7}{y}=\frac{5}{y}$

77. $\frac{5}{n}-\frac{10}{n}=\frac{5-10}{n}=\frac{-5}{n}=-\frac{5}{n}$

78. $\frac{6}{c}-\frac{13}{c}=\frac{6-13}{c}=\frac{-7}{c}=-\frac{7}{c}$

79. $\frac{3}{7}-\frac{5}{14}=\frac{6}{14}-\frac{5}{14}$
$=\frac{6-5}{14}=\frac{1}{14}$

80. $\frac{7}{8}-\frac{5}{16}=\frac{14}{16}-\frac{5}{16}$
$=\frac{14-5}{16}=\frac{9}{16}$

81. $\frac{2}{3}-\frac{1}{6}=\frac{4}{6}-\frac{1}{6}$
$=\frac{4-1}{6}=\frac{3}{6}=\frac{1}{2}$

82. $\frac{5}{21}-\frac{1}{6}=\frac{10}{42}-\frac{7}{42}$
$=\frac{10-7}{42}=\frac{3}{42}=\frac{1}{14}$

83. $\frac{11}{12}-\frac{2}{3}=\frac{11}{12}-\frac{8}{12}$
$=\frac{11-8}{12}=\frac{3}{12}=\frac{1}{4}$

84. $\frac{9}{20}-\frac{1}{30}=\frac{27}{60}-\frac{2}{60}$
$=\frac{27-2}{60}=\frac{25}{60}=\frac{5}{12}$

85. $-\frac{1}{2}-\frac{3}{8}=\frac{-1}{2}-\frac{3}{8}$
$=\frac{-4}{8}-\frac{3}{8}$
$=\frac{-4-3}{8}=\frac{-7}{8}=-\frac{7}{8}$

86. $-\frac{5}{6}-\frac{1}{9}=\frac{-5}{6}-\frac{1}{9}$
$=\frac{-15}{18}-\frac{2}{18}$
$=\frac{-15-2}{18}=\frac{-17}{18}$
$=-\frac{17}{18}$

87. $-\frac{3}{10}-\frac{4}{5}=\frac{-3}{10}-\frac{4}{5}$
$=\frac{-3}{10}-\frac{8}{10}$
$=\frac{-3-8}{10}=\frac{-11}{10}$
$=-1\frac{1}{10}$

88. $-\frac{7}{15}-\frac{3}{10}=\frac{-7}{15}-\frac{3}{10}$
$=\frac{-14}{30}-\frac{9}{30}$
$=\frac{-14-9}{30}=\frac{-23}{30}$
$=-\frac{23}{30}$

89. $-\frac{5}{12}-\left(-\frac{2}{3}\right)=\frac{-5}{12}-\frac{-2}{3}$
$=\frac{-5}{12}-\frac{-8}{12}$
$=\frac{-5-(-8)}{12}$
$=\frac{-5+8}{12}=\frac{3}{12}=\frac{1}{4}$

90. $-\frac{3}{10}-\left(-\frac{5}{6}\right)=\frac{-3}{10}-\frac{-5}{6}$
$=\frac{-9}{30}-\frac{-25}{30}$
$=\frac{-9-(-25)}{30}$
$=\frac{-9+25}{30}=\frac{16}{30}=\frac{8}{15}$

91. $-\frac{5}{9}-\left(-\frac{11}{12}\right)=\frac{-5}{9}-\frac{-11}{12}$
$=\frac{-20}{36}-\frac{-33}{36}$
$=\frac{-20-(-33)}{36}$
$=\frac{-20+33}{36}=\frac{13}{36}$

92. $-\frac{5}{8}-\left(-\frac{7}{12}\right)=\frac{-5}{8}-\frac{-7}{12}$
$=\frac{-15}{24}-\frac{-14}{24}$
$=\frac{-15-(-14)}{24}$
$=\frac{-15+14}{24}=\frac{-1}{24}=-\frac{1}{24}$

93. $4\frac{11}{18}-2\frac{5}{18}=2\frac{6}{18}=2\frac{1}{3}$

94. $3\frac{7}{12}-1\frac{1}{12}=2\frac{6}{12}=2\frac{1}{2}$

95. $8\frac{3}{4}-2=6\frac{3}{4}$

96. $6\frac{5}{9}-4=2\frac{5}{9}$

97. $8\frac{5}{6}-7\frac{3}{4}=8\frac{10}{12}-7\frac{9}{12}$
$=1\frac{1}{12}$

98. $5\frac{7}{8}-3\frac{2}{3}=5\frac{21}{24}-2\frac{16}{24}$
$=2\frac{5}{24}$

99. $7-3\frac{5}{8}=6\frac{8}{8}-3\frac{5}{8}$
$=3\frac{3}{8}$

100. $6-2\frac{4}{5}=5\frac{5}{5}-2\frac{4}{5}$
$=3\frac{1}{5}$

101. $10-4\frac{8}{9}=9\frac{9}{9}-4\frac{8}{9}$
$=5\frac{1}{9}$

102. $5-2\frac{7}{18}=4\frac{18}{18}-2\frac{7}{18}$
$=2\frac{11}{18}$

103. $7\frac{3}{8}-4\frac{5}{8}=6\frac{11}{8}-4\frac{5}{8}$
$=2\frac{6}{8}=2\frac{3}{4}$

104. $11\frac{1}{6}-8\frac{5}{6}=10\frac{7}{6}-8\frac{5}{6}$
$=2\frac{2}{6}=2\frac{1}{3}$

105. $12\frac{5}{12}-10\frac{17}{24}=12\frac{10}{24}-10\frac{17}{24}$
$=11\frac{34}{24}-10\frac{17}{24}$
$=1\frac{17}{24}$

106. $16\frac{1}{3}-11\frac{5}{12}=16\frac{4}{12}-11\frac{5}{12}$
$=15\frac{16}{12}-11\frac{5}{12}$
$=4\frac{11}{12}$

107. $6\frac{2}{3}-1\frac{7}{8}=6\frac{16}{24}-1\frac{21}{24}$
$=5\frac{40}{24}-1\frac{21}{24}$
$=4\frac{19}{24}$

108. $7\frac{7}{12}-2\frac{5}{6}=7\frac{7}{12}-2\frac{10}{12}$
$=6\frac{19}{12}-2\frac{10}{12}$
$=4\frac{9}{12}=4\frac{3}{4}$

109. $10\frac{2}{5}-8\frac{7}{10}=10\frac{4}{10}-8\frac{7}{10}$
$=9\frac{14}{10}-8\frac{7}{10}$
$=1\frac{7}{10}$

110. $5\frac{5}{6}-4\frac{7}{8}=5\frac{20}{24}-4\frac{21}{24}$
$=4\frac{44}{24}-4\frac{21}{24}$
$=\frac{23}{24}$

111. $-\frac{7}{12}-\frac{7}{9}=\frac{-7}{12}-\frac{7}{9}$
$=\frac{-21}{36}-\frac{28}{36}$
$=\frac{-21-28}{36}=\frac{-49}{36}=-1\frac{13}{36}$

112. $\frac{3}{5}-\left(-\frac{7}{10}\right)=\frac{3}{5}-\frac{-7}{10}$
$=\frac{6}{10}-\frac{-7}{10}$
$=\frac{6-(-7)}{10}$
$=\frac{6+7}{10}=\frac{13}{10}=1\frac{3}{10}$

113. $-\frac{7}{8}-\left(-\frac{2}{3}\right)=\frac{-7}{8}-\frac{-2}{3}$
$=\frac{-21}{24}-\frac{-16}{24}$
$=\frac{-21-(-16)}{24}$
$=\frac{-21+16}{24}=\frac{-5}{24}=-\frac{5}{24}$

114. $-\frac{1}{6}-\left(-\frac{8}{9}\right)=\frac{-1}{6}-\frac{-8}{9}$
$=\frac{-3}{18}-\frac{-16}{18}$
$=\frac{-3-(-16)}{18}$
$=\frac{-3+16}{18}=\frac{13}{18}$

115. $8-1\frac{7}{12}=7\frac{12}{12}-1\frac{7}{12}$
$=6\frac{5}{12}$

116. $9-5\frac{3}{20}=8\frac{20}{20}-5\frac{3}{20}$
$=3\frac{17}{20}$

117. $x-y$
$\frac{8}{9}-\frac{5}{9}=\frac{8-5}{9}=\frac{3}{9}=\frac{1}{3}$

118. $x-y$
$\frac{5}{6}-\frac{1}{6}=\frac{5-1}{6}=\frac{4}{6}=\frac{2}{3}$

119. $x-y$
$-\frac{11}{12}-\frac{5}{12}=\frac{-11}{12}-\frac{5}{12}$
$=\frac{-11-5}{12}$
$=\frac{-16}{12}=\frac{-4}{3}=-1\frac{1}{3}$

120. $x-y$
$-\frac{15}{16}-\frac{5}{16}=\frac{-15}{16}-\frac{5}{16}$
$=\frac{-15-5}{16}$
$=\frac{-20}{16}=\frac{-5}{4}=-1\frac{1}{4}$

121. $x-y$
$-\frac{2}{3}-\left(-\frac{3}{4}\right)=\frac{-2}{3}-\frac{-3}{4}$
$=\frac{-8}{12}-\frac{-9}{12}$
$=\frac{-8-(-9)}{12}$
$=\frac{-8+9}{12}=\frac{1}{12}$

122. $x-y$
$-\frac{5}{12}-\left(-\frac{5}{9}\right)=\frac{-5}{12}-\frac{-5}{9}$
$=\frac{-15}{36}-\frac{-20}{36}$
$=\frac{-15-(-20)}{36}$
$=\frac{-15+20}{36}=\frac{5}{36}$

123. $x-y$
$-\frac{3}{10}-\left(-\frac{7}{15}\right)=\frac{-3}{10}-\frac{-7}{15}$
$=\frac{-9}{30}-\frac{-14}{30}$
$=\frac{-9-(-14)}{30}$
$=\frac{-9+14}{30}=\frac{5}{30}=\frac{1}{6}$

124. $x-y$
$-\frac{5}{6}-\left(-\frac{2}{15}\right)=\frac{-5}{6}-\frac{-2}{15}$
$=\frac{-25}{30}-\frac{-4}{30}$
$=\frac{-25-(-4)}{30}$
$=\frac{-25+4}{30}=\frac{-21}{30}=-\frac{7}{10}$

125. $x-y$
$5\frac{7}{9}-4\frac{2}{3}=5\frac{7}{9}-4\frac{6}{9}$
$=1\frac{1}{9}$

126. $x-y$

$$9\tfrac{5}{8}-2\tfrac{3}{16}=9\tfrac{10}{16}-2\tfrac{3}{16}$$
$$=7\tfrac{7}{16}$$

127. $x-y$

$$7\tfrac{9}{10}-3\tfrac{1}{2}=7\tfrac{9}{10}-3\tfrac{5}{10}$$
$$=4\tfrac{4}{10}=4\tfrac{2}{5}$$

128. $x-y$

$$6\tfrac{4}{9}-1\tfrac{1}{6}=6\tfrac{8}{18}-1\tfrac{3}{18}$$
$$=5\tfrac{5}{18}$$

129. $x-y$

$$5-2\tfrac{7}{9}=4\tfrac{9}{9}-2\tfrac{7}{9}$$
$$=2\tfrac{2}{9}$$

130. $x-y$

$$8-4\tfrac{5}{6}=7\tfrac{6}{6}-4\tfrac{5}{6}$$
$$=3\tfrac{1}{6}$$

131. $x-y$

$$10\tfrac{1}{2}-5\tfrac{7}{12}=10\tfrac{6}{12}-5\tfrac{7}{12}$$
$$=9\tfrac{18}{12}-5\tfrac{7}{12}=4\tfrac{11}{12}$$

132. $x-y$

$$9\tfrac{2}{15}-6\tfrac{11}{15}=8\tfrac{17}{15}-6\tfrac{11}{15}$$
$$=2\tfrac{6}{15}=2\tfrac{2}{5}$$

133. $\frac{4}{5}=\frac{31}{20}-y$

$$\begin{array}{c|l}
\frac{4}{5} & \frac{31}{20}-\left(-\frac{3}{4}\right) \\
\frac{4}{5} & \frac{31}{20}-\left(-\frac{15}{20}\right) \\
\frac{4}{5} & \frac{31-(-15)}{20} \\
\frac{4}{5} & \frac{31+15}{20} \\
\frac{4}{5} & \frac{46}{20} \\
\frac{4}{5} & \frac{23}{10}
\end{array}$$
$$\frac{8}{10}\neq\frac{23}{10}$$

No, $-\frac{3}{4}$ is not a solution of the equation.

134. $-\frac{1}{4}=x-\frac{7}{8}$

$$\begin{array}{c|c}
-\frac{1}{4} & \frac{5}{8}-\frac{7}{8} \\
-\frac{1}{4} & \frac{5-7}{8} \\
-\frac{1}{4} & \frac{-2}{8}
\end{array}$$
$$-\frac{1}{4}=-\frac{1}{4}$$

Yes, $\frac{5}{8}$ is a solution of the equation.

135. $x-\frac{1}{4}=-\frac{17}{20}$

$$\begin{array}{c|c}
-\frac{3}{5}-\frac{1}{4} & -\frac{17}{20} \\
-\frac{12}{20}-\frac{5}{20} & -\frac{17}{20} \\
\frac{-12-5}{20} & -\frac{17}{20}
\end{array}$$
$$-\frac{17}{20}=-\frac{17}{20}$$

Yes, $-\frac{3}{5}$ is a solution of the equation.

136. $\frac{2}{3}-x=0$

$$\begin{array}{c|c}
\frac{2}{3}-\left(-\frac{2}{3}\right) & 0 \\
\frac{2-(-2)}{3} & 0 \\
\frac{2+2}{3} & 0
\end{array}$$
$$\frac{4}{3}\neq 0$$

No, $-\frac{2}{3}$ is not a solution of the equation.

137. $\frac{12}{25}-\frac{8}{75}=\frac{36}{75}-\frac{8}{75}=\frac{28}{75}$

The difference between the fraction of personal income taxes and corporate income taxes is $\frac{28}{75}$.

138. $\frac{1}{3}-\frac{2}{25}=\frac{25}{75}-\frac{6}{75}=\frac{19}{75}$

The difference between the fraction of Social Security category and miscellaneous taxes is $\frac{19}{75}$.

Objective C Exercises, pages 186–188

139. Strategy To find the amount of property owned, subtract the amount sold $\left(1\frac{1}{2}\right)$ from the amount originally owned $\left(3\frac{1}{4}\right)$.

Solution
$$3\frac{1}{4}-1\frac{1}{2}=3\frac{1}{4}-1\frac{2}{4}$$
$$=2\frac{5}{4}-1\frac{2}{4}$$
$$=1\frac{3}{4}$$
You now own $1\frac{3}{4}$ acres.

140. Strategy To find the length, subtract the $2\frac{3}{4}$-foot piece from the length of the original board (6).

Solution
$$6-2\frac{3}{4}=5\frac{4}{4}-2\frac{3}{4}$$
$$=3\frac{1}{4}$$
The remaining piece of board is $3\frac{1}{4}$ ft long.

141. Strategy To find the number of hours still required, subtract the number of hours already contributed $\left(12\frac{1}{4}\right)$ from the original amount required (20).

Solution
$$20-12\frac{1}{4}=19\frac{4}{4}=12\frac{1}{4}$$
$$=7\frac{3}{4}$$
$7\frac{3}{4}$ h of community service are still required.

142. Strategy To find how much farther the horses run in

→The Kentucky Derby than the Preakness, subtract the distance the horses run in the Preakness $\left(1\frac{3}{16}\right)$ from the distance the horses run in the Kentucky Derby $\left(1\frac{1}{4}\right)$.

→The Belmont Stakes than the Preakness, subtract the distance the horses run in the Preakness $\left(1\frac{3}{16}\right)$ from the distance the horses run in the Belmont Stakes $\left(1\frac{1}{2}\right)$.

Solution
$$1\frac{1}{4}-1\frac{3}{16}=1\frac{4}{16}-1\frac{3}{16}=\frac{1}{16}$$
$$1\frac{1}{2}-1\frac{3}{16}=1\frac{8}{16}-1\frac{3}{16}=\frac{5}{16}$$
The horses ran $\frac{1}{16}$ mi farther in the Kentucky Derby and $\frac{5}{16}$ mi farther in the Belmont Stakes.

143. Strategy To find the amount of weight to gain:

$\rightarrow$Add the amounts already gained $\left(4\frac{1}{2}+3\frac{3}{4}\right)$.

$\rightarrow$Subtract the amount gained from the goal amount (15).

Solution $4\frac{1}{2}+3\frac{3}{4}=4\frac{2}{4}+3\frac{3}{4}=7\frac{5}{4}=8\frac{1}{4}$

$15-8\frac{1}{4}=14\frac{4}{4}-8\frac{1}{4}=6\frac{3}{4}$

The boxer has $6\frac{3}{4}$ lb left to gain.

144. Strategy To find the amount of roofing that remains:

$\rightarrow$Add the amounts already done $\left(\frac{1}{3}+\frac{1}{4}\right)$.

$\rightarrow$Subtract the amount ready done from the total job (1).

To determine if the roofers can finish in another day, compare the amount already done with $\frac{1}{2}$.

Solution $\frac{1}{3}+\frac{1}{4}=\frac{4}{12}+\frac{3}{12}=\frac{7}{12}$

$1-\frac{7}{12}=\frac{12}{12}-\frac{7}{12}=\frac{5}{12}$

$\frac{5}{12}$ of the roofing job remains to be done.

Since $\frac{5}{12}$ is less than $\frac{1}{2}$, the roofing can be finished in another day.

145. Strategy

a. To find which response was given most frequently, compare all the responses.

b. To find the fraction, add the fractions of those who cook $0\left(\frac{2}{25}\right)$, $1\left(\frac{1}{20}\right)$ and $2\left(\frac{1}{10}\right)$ dinners at home.

c. To find the fraction, add the fractions of those who cook $5\left(\frac{21}{100}\right)$, $6\left(\frac{9}{100}\right)$, and $7\left(\frac{19}{100}\right)$ dinners at home. Then compare the result to $\left(\frac{1}{2}\right)$.

Solution

a. $\frac{2}{25}=\frac{8}{100}$

$\frac{1}{20}=\frac{5}{100}$

$\frac{1}{10}=\frac{10}{100}$

$\frac{3}{20}=\frac{15}{100}$

$\frac{21}{100}>\frac{19}{100}>\frac{15}{100}>\frac{13}{100}>\frac{10}{100}>\frac{9}{100}>\frac{8}{100}>\frac{5}{100}$

The response that was given most frequently was 5 dinners at home per week.

b. $\frac{2}{25}+\frac{1}{20}+\frac{1}{10}=\frac{8}{100}+\frac{5}{100}+\frac{10}{100}=\frac{23}{100}$

The fraction of the adult population cooking two or fewer dinners is $\frac{23}{100}$.

c. $\frac{21}{100}+\frac{9}{100}+\frac{19}{100}=\frac{49}{100}$

$\frac{1}{2}=\frac{50}{100}$

$\frac{49}{100}<\frac{50}{100}$

The fraction of the adult population cooking five or more dinners is $\frac{49}{100}$. This is less than half of the people.

146. Strategy To find the amount earned:

→Add the times worked $\left(4\frac{1}{3}+5+3\frac{2}{3}\right)$.

→Multiply the hours worked by 7.

Solution $4\frac{1}{3}+5+3\frac{2}{3}=12\frac{3}{3}=13$

$13\cdot 7=91$

The student earned \$91.

147. Strategy

a. To find the difference in GM stock, subtract the low $\left(59\frac{3}{4}\right)$ from the high $\left(94\frac{5}{8}\right)$.

b. To find the how much greater Toyota's high was than GM's high, subtract GM's high $\left(94\frac{5}{8}\right)$ from Toyota's high $\left(108\frac{1}{4}\right)$.

Solution

a. $94\frac{5}{8}-59\frac{3}{4}=94\frac{5}{8}-59\frac{6}{8}=34\frac{7}{8}$

The difference between the high and low for GM's stock was $\$34\frac{7}{8}$.

b. $108\frac{1}{4}-94\frac{5}{8}=108\frac{2}{8}-94\frac{5}{8}=49\frac{5}{8}$

Toyota's high was $\$49\frac{5}{8}$ greater than GM's high.

148. Strategy To find (a) the smallest difference and (b) the greatest difference:
→Estimate the difference between the high and low for each stock.
→Find (a) the smallest difference, and (b) the greatest difference.

Solution Ford: $59-40=19$
GM: $95-60=35$
Honda: $91-65=26$
Toyota: $108-55=53$
Volvo: $32-23=9$
(a) The smallest difference between the high and the low is Volvo.
(b) The greatest difference between the high and the low is Toyota.

149. Strategy To find the feet of fencing, replace *a*, *b*, and *c* with $6\frac{1}{4}$, $10\frac{3}{4}$, and $12\frac{1}{2}$ in the given formula and solve for *P*.

Solution $P=a+b+c$

$$P=6\frac{1}{4}+10\frac{3}{4}+12\frac{1}{2}=6\frac{1}{4}+10\frac{3}{4}+12\frac{2}{4}=29\frac{1}{2}$$

The number of feet of fencing needed is $29\frac{1}{2}$ ft.

150. Strategy To find course length, replace a, b, and c with $4\frac{3}{10}$, $3\frac{7}{10}$, and $2\frac{1}{2}$ in the given formula and solve for P.

Solution $P = a + b + c$

$$P = 4\frac{3}{10} + 3\frac{7}{10} + 2\frac{1}{2} = 4\frac{3}{10} + 3\frac{7}{10} + 2\frac{5}{10} = 10\frac{1}{2}$$

The total length of the course is $10\frac{1}{2}$ mi.

151. Strategy To find length of wood beams, replace a, b, and c with $25\frac{3}{4}$, $12\frac{1}{2}$, and $17\frac{1}{2}$ in the given formula and solve for P.

Solution $P = a + b + c$

$$P = 25\frac{3}{4} + 12\frac{1}{2} + 17\frac{1}{2} = 25\frac{3}{4} + 12\frac{2}{4} + 17\frac{2}{4} = 55\frac{3}{4}$$

The total length of wood beams needed is $55\frac{3}{4}$ ft.

152. Strategy To find the gain per share, replace S by $29\frac{3}{4}$ and P by $23\frac{1}{8}$ in the given formula and solve for G.

Solution $G = S - P$

$$G = 29\frac{3}{4} - 23\frac{1}{8}$$

$$G = 29\frac{6}{8} - 23\frac{1}{8} = 6\frac{5}{8}$$

The gain was $\$6\frac{5}{8}$ per share.

153. Strategy To find the loss per share, replace P by $9\frac{1}{4}$ and S by $6\frac{7}{8}$ in the given formula and solve for L.

Solution $L = P - S$

$$L = 9\frac{1}{4} - 6\frac{7}{8}$$

$$L = 9\frac{2}{8} - 6\frac{7}{8}$$

$$L = 8\frac{10}{8} - 6\frac{7}{8} = 2\frac{3}{8}$$

The loss was $\$2\frac{3}{8}$ per share.

154. Strategy To find the loss per share, replace P by $37\frac{3}{4}$ and S by $31\frac{5}{8}$ in the given formula and solve for L.

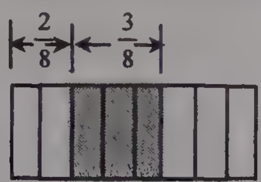
Solution
$$L = P - S$$
$$L = 37\frac{3}{4} - 31\frac{5}{8}$$
$$L = 37\frac{6}{8} - 31\frac{5}{8}$$
$$L = 6\frac{1}{8}$$

The loss was $\$6\frac{1}{8}$ per share.

Critical Thinking 3.3, page 180

155. No, because the parts are not equal in size.

156. Fractions with the same denominator are added by adding the numerators and placing the sum over the common denominator.



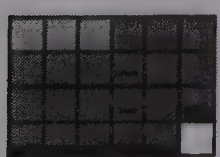
$$\frac{2}{8} + \frac{3}{8} = \frac{2+3}{8} = \frac{5}{8}$$

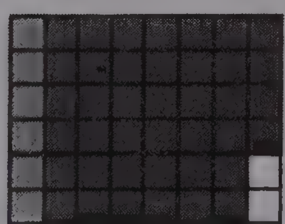
157. $\frac{1}{8}$ is 3 squares. $\frac{5}{6}$ is 20 squares.

No, $\frac{1}{8} + \frac{5}{6}$ of the rectangle is not 24 squares.

When the figure contains 48 squares, $\frac{1}{8}$ is 6 squares. $\frac{5}{6}$ is 40 squares. If there were 16 squares, $\frac{1}{8}$ and $\frac{5}{6}$ could not be illustrated (unless fractions of squares were used).

The possible number of squares that could be used to illustrate the sum of $\frac{1}{8}$ and $\frac{5}{6}$ include 24, 48, 72, 96, … The list includes all the multiples of 24, or the common multiples of 6 and 8.





Section 3.4

Objective A Exercises, pages 199–201

3. $\frac{2}{3}\cdot\frac{9}{10}=\frac{2\cdot 9}{3\cdot 10}$
$=\frac{2\cdot 3\cdot 3}{3\cdot 2\cdot 5}$
$=\frac{3}{5}$

4. $\frac{3}{8}\cdot\frac{4}{5}=\frac{3\cdot 4}{8\cdot 5}$
$=\frac{3\cdot 2\cdot 2}{2\cdot 2\cdot 2\cdot 5}$
$=\frac{3}{10}$

5. $-\frac{6}{7}\cdot\frac{11}{12}=-\frac{6\cdot 11}{7\cdot 12}$
$=-\frac{2\cdot 3\cdot 11}{7\cdot 2\cdot 2\cdot 3}$
$=-\frac{11}{14}$

6. $\frac{5}{6}\cdot\left(-\frac{2}{5}\right)=-\left(\frac{5}{6}\cdot\frac{2}{5}\right)$
$=-\frac{5\cdot 2}{6\cdot 5}$
$=-\frac{5\cdot 2}{2\cdot 3\cdot 5}$
$=-\frac{1}{3}$

7. $\frac{14}{15}\cdot\frac{6}{7}=\frac{14\cdot 6}{15\cdot 7}$
$=\frac{2\cdot 7\cdot 2\cdot 3}{3\cdot 5\cdot 7}$
$=\frac{4}{5}$

8. $\frac{15}{16}\cdot\frac{4}{9}=\frac{15\cdot 4}{16\cdot 9}$
$=\frac{3\cdot 5\cdot 2\cdot 2}{2\cdot 2\cdot 2\cdot 2\cdot 3\cdot 3}$
$=\frac{5}{12}$

9. $-\frac{6}{7}\cdot\frac{0}{10}=-\left(\frac{6}{7}\cdot\frac{0}{10}\right)$
$=-\frac{6\cdot 0}{7\cdot 10}$
$=-\frac{0}{70}=0$

10. $\frac{5}{12}\cdot\frac{3}{0}=\frac{5\cdot 3}{12\cdot 0}$
$=\frac{15}{0}$
Division by zero is undefined.

11. $\left(-\frac{4}{15}\right)\left(-\frac{3}{8}\right)=\frac{4}{15}\cdot\frac{3}{8}$
$=\frac{4\cdot 3}{15\cdot 8}$
$=\frac{2\cdot 2\cdot 3}{3\cdot 5\cdot 2\cdot 2\cdot 2}$
$=\frac{1}{10}$

12. $\left(-\frac{3}{4}\right)\left(-\frac{2}{9}\right)=\frac{3}{4}\cdot\frac{2}{9}$
$=\frac{3\cdot 2}{4\cdot 9}$
$=\frac{3\cdot 2}{2\cdot 2\cdot 3\cdot 3}$
$=\frac{1}{6}$

13. $-\frac{3}{4}\cdot\frac{1}{2}=-\left(\frac{3}{4}\cdot\frac{1}{2}\right)$
$=-\frac{3\cdot 1}{4\cdot 2}$
$=-\frac{3\cdot 1}{2\cdot 2\cdot 2}$
$=-\frac{3}{8}$

14. $-\frac{8}{15}\cdot\frac{5}{12}=-\left(\frac{8}{15}\cdot\frac{5}{12}\right)$
$=-\frac{8\cdot 5}{15\cdot 12}$
$=-\frac{2\cdot 2\cdot 2\cdot 5}{3\cdot 5\cdot 2\cdot 2\cdot 3}$
$=-\frac{2}{9}$

15. $\frac{9}{x}\cdot\frac{7}{y}=\frac{9\cdot 7}{x\cdot y}$
$=\frac{63}{xy}$

16. $\frac{4}{c}\cdot\frac{8}{d}=\frac{4\cdot 8}{c\cdot d}$
$=\frac{32}{cd}$

17. $-\frac{y}{5}\cdot\frac{z}{6}=-\left(\frac{y}{5}\cdot\frac{z}{6}\right)$
$=-\frac{y\cdot z}{5\cdot 6}$
$=-\frac{yz}{30}$

18. $-\frac{a}{10}\cdot\left(-\frac{b}{6}\right)=\frac{a}{10}\cdot\frac{b}{6}$
$=\frac{a\cdot b}{10\cdot 6}$
$=\frac{ab}{60}$

19. $$\begin{aligned}\frac{2}{3}\cdot\frac{3}{8}\cdot\frac{4}{9}&=\frac{2\cdot3\cdot4}{3\cdot8\cdot9}\\&=\frac{2\cdot3\cdot2\cdot2}{3\cdot2\cdot2\cdot2\cdot3\cdot3}\\&=\frac{1}{9}\end{aligned}$$

20. $$\begin{aligned}\frac{5}{7}\cdot\frac{1}{6}\cdot\frac{14}{15}&=\frac{5\cdot1\cdot14}{7\cdot6\cdot15}\\&=\frac{5\cdot1\cdot2\cdot7}{7\cdot2\cdot3\cdot3\cdot5}\\&=\frac{1}{9}\end{aligned}$$

21. $$\begin{aligned}-\frac{7}{12}\cdot\frac{5}{8}\cdot\frac{16}{25}&=-\left(\frac{7}{12}\cdot\frac{5}{8}\cdot\frac{16}{25}\right)\\&=-\frac{7\cdot5\cdot16}{12\cdot8\cdot25}\\&=-\frac{7\cdot5\cdot2\cdot2\cdot2\cdot2}{2\cdot2\cdot3\cdot2\cdot2\cdot2\cdot5\cdot5}\\&=-\frac{7}{30}\end{aligned}$$

22. $$\begin{aligned}\frac{5}{12}\cdot\left(-\frac{1}{3}\right)\left(-\frac{8}{15}\right)&=\frac{5}{12}\cdot\frac{1}{3}\cdot\frac{8}{15}\\&=\frac{5\cdot1\cdot8}{12\cdot3\cdot15}\\&=\frac{5\cdot1\cdot2\cdot2\cdot2}{2\cdot2\cdot3\cdot3\cdot3\cdot5}\\&=\frac{2}{27}\end{aligned}$$

23. $$\begin{aligned}\left(-\frac{3}{5}\right)\frac{1}{2}\cdot\left(-\frac{5}{8}\right)&=\frac{3}{5}\cdot\frac{1}{2}\cdot\frac{5}{8}\\&=\frac{3\cdot1\cdot5}{5\cdot2\cdot8}\\&=\frac{3\cdot1\cdot5}{5\cdot2\cdot2\cdot2\cdot2}\\&=\frac{3}{16}\end{aligned}$$

24. $$\begin{aligned}\frac{5}{6}\cdot\left(-\frac{2}{3}\right)\frac{3}{25}&=-\left(\frac{5}{6}\cdot\frac{2}{3}\cdot\frac{3}{25}\right)\\&=-\frac{5\cdot2\cdot3}{6\cdot3\cdot25}\\&=-\frac{5\cdot2\cdot3}{2\cdot3\cdot3\cdot5\cdot5}\\&=-\frac{1}{15}\end{aligned}$$

25. $$\begin{aligned}6\cdot\frac{1}{6}&=\frac{6}{1}\cdot\frac{1}{6}\\&=\frac{6\cdot1}{1\cdot6}\\&=\frac{6}{6}=1\end{aligned}$$

26. $$\begin{aligned}\frac{1}{10}\cdot10&=\frac{1}{10}\cdot\frac{10}{1}\\&=\frac{1\cdot10}{10\cdot1}\\&=\frac{10}{10}=1\end{aligned}$$

27. $$\begin{aligned}\frac{3}{4}\cdot8&=\frac{3}{4}\cdot\frac{8}{1}\\&=\frac{3\cdot8}{4\cdot1}\\&=\frac{3\cdot2\cdot2\cdot2}{2\cdot2\cdot1}=\frac{6}{1}=6\end{aligned}$$

28. $$\begin{aligned}\frac{5}{7}\cdot14&=\frac{5}{7}\cdot\frac{14}{1}\\&=\frac{5\cdot14}{7\cdot1}=\frac{5\cdot2\cdot7}{7\cdot1}\\&=\frac{10}{1}=10\end{aligned}$$

29. $$\begin{aligned}12\cdot\left(-\frac{5}{8}\right)&=-\left(12\cdot\frac{5}{8}\right)\\&=-\left(\frac{12}{1}\cdot\frac{5}{8}\right)=-\frac{12\cdot5}{1\cdot8}\\&=-\frac{2\cdot2\cdot3\cdot5}{1\cdot2\cdot2\cdot2}\\&=-\frac{15}{2}=-7\frac{1}{2}\end{aligned}$$

30. $$\begin{aligned}24\cdot\left(-\frac{3}{8}\right)&=-\left(24\cdot\frac{3}{8}\right)\\&=-\left(\frac{24}{1}\cdot\frac{3}{8}\right)=-\frac{24\cdot3}{1\cdot8}\\&=-\frac{2\cdot2\cdot2\cdot3\cdot3}{2\cdot2\cdot2}\\&=-\frac{9}{1}=-9\end{aligned}$$

31. $$\begin{aligned}-16\cdot\frac{7}{30}&=-\left(\frac{16}{1}\cdot\frac{7}{30}\right)\\&=-\frac{16\cdot7}{1\cdot30}\\&=-\frac{2\cdot2\cdot2\cdot2\cdot7}{1\cdot2\cdot3\cdot5}\\&=-\frac{56}{15}=-3\frac{11}{15}\end{aligned}$$

32. $$\begin{aligned}-9\cdot\frac{7}{15}&=-\left(\frac{9}{1}\cdot\frac{7}{15}\right)\\&=-\frac{9\cdot7}{1\cdot15}\\&=-\frac{3\cdot3\cdot7}{1\cdot3\cdot5}\\&=-\frac{21}{5}=-4\frac{1}{5}\end{aligned}$$

33. $\frac{6}{7}\cdot 0=0$

34. $0\cdot\frac{9}{11}=0$

35. $\frac{5}{22}\cdot 2\frac{1}{5}=\frac{5}{22}\cdot\frac{11}{5}$
$=\frac{5\cdot 11}{22\cdot 5}$
$=\frac{5\cdot 11}{2\cdot 11\cdot 5}$
$=\frac{1}{2}$

36. $\frac{4}{15}\cdot 1\frac{7}{8}=\frac{4}{15}\cdot\frac{15}{8}$
$=\frac{4\cdot 15}{15\cdot 8}$
$=\frac{2\cdot 2\cdot 3\cdot 5}{3\cdot 5\cdot 2\cdot 2\cdot 2}$
$=\frac{1}{2}$

37. $3\frac{1}{2}\cdot 5\frac{3}{7}=\frac{7}{2}\cdot\frac{38}{7}$
$=\frac{7\cdot 38}{2\cdot 7}$
$=\frac{7\cdot 2\cdot 19}{2\cdot 7}$
$=\frac{19}{1}=19$

38. $2\frac{1}{4}\cdot 1\frac{1}{3}=\frac{9}{4}\cdot\frac{4}{3}$
$=\frac{9\cdot 4}{4\cdot 3}$
$=\frac{3\cdot 3\cdot 2\cdot 2}{2\cdot 2\cdot 3}$
$=\frac{3}{1}=3$

39. $3\frac{1}{3}\cdot\left(-\frac{7}{10}\right)=-\left(\frac{10}{3}\cdot\frac{7}{10}\right)$
$=-\frac{10\cdot 7}{3\cdot 10}$
$=-\frac{2\cdot 5\cdot 7}{3\cdot 2\cdot 5}$
$=-\frac{7}{3}=-2\frac{1}{3}$

40. $2\frac{1}{4}\cdot\left(-\frac{7}{9}\right)=-\left(\frac{9}{4}\cdot\frac{7}{9}\right)$
$=-\frac{9\cdot 7}{4\cdot 9}$
$=-\frac{3\cdot 3\cdot 7}{2\cdot 2\cdot 3\cdot 3}$
$=-\frac{7}{4}=-1\frac{3}{4}$

41. $-1\frac{2}{3}\cdot\left(-\frac{3}{5}\right)=\frac{5}{3}\cdot\frac{3}{5}$
$=\frac{5\cdot 3}{3\cdot 5}$
$=1$

42. $-2\frac{1}{8}\cdot\left(-\frac{4}{17}\right)=\frac{17}{8}\cdot\frac{4}{17}$
$=\frac{17\cdot 4}{8\cdot 17}$
$=\frac{17\cdot 2\cdot 2}{2\cdot 2\cdot 2\cdot 17}$
$=\frac{1}{2}$

43. $3\frac{1}{3}\cdot 2\frac{1}{3}=\frac{10}{3}\cdot\frac{7}{3}$
$=\frac{10\cdot 7}{3\cdot 3}$
$=\frac{2\cdot 5\cdot 7}{3\cdot 3}$
$=\frac{70}{9}=7\frac{7}{9}$

44. $3\frac{1}{4}\cdot 2\frac{2}{3}=\frac{13}{4}\cdot\frac{8}{3}$
$=\frac{13\cdot 8}{4\cdot 3}$
$=\frac{13\cdot 2\cdot 2\cdot 2}{2\cdot 2\cdot 3}$
$=\frac{26}{3}=8\frac{2}{3}$

45. $3\frac{1}{3}\cdot(-9)=-\left(\frac{10}{3}\cdot\frac{9}{1}\right)$
$=-\frac{10\cdot 9}{3\cdot 1}$
$=-\frac{2\cdot 5\cdot 3\cdot 3}{3\cdot 1}$
$=-\frac{30}{1}=-30$

46. $-2\frac{1}{2}\cdot 4=-\left(\frac{5}{2}\cdot\frac{4}{1}\right)$
$=-\frac{5\cdot 4}{2\cdot 1}$
$=-\frac{5\cdot 2\cdot 2}{2\cdot 1}$
$=-\frac{10}{1}=-10$

47. $8\cdot 5\frac{1}{4}=\frac{8}{1}\cdot\frac{21}{4}$
$=\frac{8\cdot 21}{1\cdot 4}$
$=\frac{2\cdot 2\cdot 2\cdot 3\cdot 7}{1\cdot 2\cdot 2}$
$=\frac{42}{1}=42$

48. $3 \cdot 2\frac{1}{9} = \frac{3}{1} \cdot \frac{19}{9}$
$= \frac{3 \cdot 19}{1 \cdot 3 \cdot 3}$
$= \frac{19}{3}$
$= 6\frac{1}{3}$

49. $3\frac{1}{2} \cdot 1\frac{5}{7} \cdot \frac{11}{12} = \frac{7}{2} \cdot \frac{12}{7} \cdot \frac{11}{12}$
$= \frac{7 \cdot 12 \cdot 11}{2 \cdot 7 \cdot 12}$
$= \frac{7 \cdot 2 \cdot 2 \cdot 3 \cdot 11}{2 \cdot 7 \cdot 2 \cdot 2 \cdot 3}$
$= \frac{11}{2} = 5\frac{1}{2}$

50. $2\frac{2}{3} \cdot \frac{8}{9} \cdot 1\frac{5}{16} = \frac{8}{3} \cdot \frac{8}{9} \cdot \frac{21}{16}$
$= \frac{8 \cdot 8 \cdot 21}{3 \cdot 9 \cdot 16}$
$\frac{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 7}{3 \cdot 3 \cdot 3 \cdot 2 \cdot 2 \cdot 2 \cdot 2}$
$= \frac{28}{9} = 3\frac{1}{9}$

51. $\frac{3}{4} \cdot \frac{14}{15} = \frac{3 \cdot 14}{4 \cdot 15}$
$= \frac{3 \cdot 2 \cdot 7}{2 \cdot 2 \cdot 3 \cdot 5}$
$= \frac{7}{10}$

52. $\frac{12}{25} \cdot \frac{5}{16} = \frac{12 \cdot 5}{25 \cdot 16}$
$= \frac{2 \cdot 2 \cdot 3 \cdot 5}{5 \cdot 5 \cdot 2 \cdot 2 \cdot 2 \cdot 2}$
$= \frac{3}{20}$

53. $-\frac{9}{16} \cdot \frac{4}{27} = -\left(\frac{9 \cdot 4}{16 \cdot 27}\right)$
$= -\frac{3 \cdot 3 \cdot 2 \cdot 2}{2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 3}$
$= -\frac{1}{12}$

54. $\frac{3}{7} \cdot \left(-\frac{14}{15}\right) = -\left(\frac{3 \cdot 14}{7 \cdot 15}\right)$
$= -\frac{3 \cdot 2 \cdot 7}{7 \cdot 3 \cdot 5}$
$= -\frac{2}{5}$

55. $-\frac{7}{24} \cdot \frac{8}{21} \cdot \frac{3}{7} = -\left(\frac{7}{24} \cdot \frac{8}{21} \cdot \frac{3}{7}\right)$
$= -\frac{7 \cdot 8 \cdot 3}{24 \cdot 21 \cdot 7}$
$= -\frac{7 \cdot 2 \cdot 2 \cdot 2 \cdot 3}{2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 7 \cdot 7}$
$= -\frac{1}{21}$

56. $-\frac{5}{13} \cdot \left(-\frac{26}{75}\right)\frac{5}{8} = \frac{5}{13} \cdot \frac{26}{75} \cdot \frac{5}{8}$
$= \frac{5 \cdot 26 \cdot 5}{13 \cdot 75 \cdot 8}$
$= \frac{5 \cdot 2 \cdot 13 \cdot 5}{13 \cdot 3 \cdot 5 \cdot 5 \cdot 2 \cdot 2 \cdot 2}$
$= \frac{1}{12}$

57. $4\frac{4}{5} \cdot \frac{3}{8} = \frac{24}{5} \cdot \frac{3}{8}$
$= \frac{24 \cdot 3}{5 \cdot 8}$
$\frac{2 \cdot 2 \cdot 2 \cdot 3 \cdot 3}{5 \cdot 2 \cdot 2 \cdot 2}$
$= \frac{9}{5} = 1\frac{4}{5}$

58. $5\frac{1}{3} \cdot \frac{3}{16} = \frac{16}{3} \cdot \frac{3}{16}$
$= \frac{16 \cdot 3}{3 \cdot 16}$
$= \frac{2 \cdot 2 \cdot 2 \cdot 2 \cdot 3}{3 \cdot 2 \cdot 2 \cdot 2 \cdot 2}$
$= \frac{1}{1} = 1$

59. $-2\frac{2}{3} \cdot \left(-1\frac{11}{16}\right) = \frac{8}{3} \cdot \frac{27}{16}$
$= \frac{8 \cdot 27}{3 \cdot 16}$
$= \frac{2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 3}{3 \cdot 2 \cdot 2 \cdot 2 \cdot 2}$
$= \frac{9}{2} = 4\frac{1}{2}$

60. $1\frac{3}{11} \cdot 5\frac{1}{2} = \frac{14}{11} \cdot \frac{11}{2}$
$= \frac{14 \cdot 11}{11 \cdot 2}$
$= \frac{2 \cdot 7 \cdot 11}{11 \cdot 2}$
$= \frac{7}{1} = 7$

61. Strategy To find the amount spent on housing, multiply the housing fraction $\left(\frac{13}{45}\right)$ by the income (45,000).

Solution $45{,}000 \cdot \frac{13}{45} = 13{,}000$

The typical household spends \$13,000 per year on housing.

62. Strategy To find the amount spent on food, multiply the food fraction $\left(\frac{2}{15}\right)$ by the income (45,000).

Solution $45{,}000 \cdot \frac{2}{15} = 6{,}000$

The typical household spends \$6,000 per year on housing.

63. *xy*

$$-\frac{5}{16} \cdot \frac{7}{15} = -\left(\frac{5 \cdot 7}{16 \cdot 15}\right)$$
$$= -\frac{5 \cdot 7}{2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 5}$$
$$= -\frac{7}{48}$$

64. *xy*

$$-\frac{2}{5} \cdot \left(-\frac{5}{6}\right) = \frac{2 \cdot 5}{5 \cdot 6}$$
$$= \frac{2 \cdot 5}{5 \cdot 2 \cdot 3}$$
$$= \frac{1}{3}$$

65. *xy*

$$\frac{4}{7} \cdot 6\frac{1}{8} = \frac{4}{7} \cdot \frac{49}{8}$$
$$= \frac{4 \cdot 49}{7 \cdot 8}$$
$$= \frac{2 \cdot 2 \cdot 7 \cdot 7}{7 \cdot 2 \cdot 2 \cdot 2}$$
$$= \frac{7}{2} = 3\frac{1}{2}$$

66. *xy*

$$6\frac{3}{5} \cdot 3\frac{1}{3} = \frac{33}{5} \cdot \frac{10}{3}$$
$$= \frac{33 \cdot 10}{5 \cdot 3}$$
$$= \frac{3 \cdot 11 \cdot 2 \cdot 5}{5 \cdot 3}$$
$$= \frac{22}{1} = 22$$

67. *xy*

$$-49 \cdot \frac{5}{14} = -\left(\frac{49}{1} \cdot \frac{5}{14}\right)$$
$$= -\frac{49 \cdot 5}{1 \cdot 14}$$
$$= -\frac{7 \cdot 7 \cdot 5}{1 \cdot 2 \cdot 7}$$
$$= -\frac{35}{2} = -17\frac{1}{2}$$

68. *xy*

$$-\frac{3}{10} \cdot (-35) = \frac{3}{10} \cdot \frac{35}{1}$$
$$= \frac{3 \cdot 35}{10 \cdot 1}$$
$$= \frac{3 \cdot 5 \cdot 7}{2 \cdot 5 \cdot 1}$$
$$= \frac{21}{2} = 10\frac{1}{2}$$

69. *xy*

$$1\frac{3}{13} \cdot \left(-6\frac{1}{2}\right) = -\left(\frac{16}{13} \cdot \frac{13}{2}\right)$$
$$= -\frac{16 \cdot 13}{13 \cdot 2}$$
$$= -\frac{2 \cdot 2 \cdot 2 \cdot 2 \cdot 13}{13 \cdot 2}$$
$$= -\frac{8}{1} = -8$$

70. *xy*

$$-3\frac{1}{2} \cdot \left(-2\frac{2}{7}\right) = \frac{7}{2} \cdot \frac{16}{7}$$
$$= \frac{7 \cdot 16}{2 \cdot 7}$$
$$= \frac{7 \cdot 2 \cdot 2 \cdot 2 \cdot 2}{2 \cdot 7}$$
$$= \frac{8}{1} = 8$$

71. *xyz*

$$\frac{3}{8} \cdot \frac{2}{3} \cdot \frac{4}{5} = \frac{3 \cdot 2 \cdot 4}{8 \cdot 3 \cdot 5}$$
$$= \frac{3 \cdot 2 \cdot 2 \cdot 2}{2 \cdot 2 \cdot 2 \cdot 3 \cdot 5}$$
$$= \frac{1}{5}$$

72. *xyz*

$$4 \cdot \frac{0}{8} \cdot 1\frac{5}{9} = \frac{4}{1} \cdot \frac{0}{8} \cdot \frac{14}{9}$$
$$= \frac{4 \cdot 0 \cdot 14}{1 \cdot 8 \cdot 9}$$
$$= \frac{0}{72} = 0$$

73. *xyz*

$$2\frac{3}{8}\cdot\left(-\frac{3}{19}\right)\left(-\frac{4}{9}\right)=\frac{19}{8}\cdot\frac{3}{19}\cdot\frac{4}{9}$$
$$=\frac{19\cdot3\cdot4}{8\cdot19\cdot9}$$
$$=\frac{19\cdot3\cdot2\cdot2}{2\cdot2\cdot2\cdot19\cdot3\cdot3}$$
$$=\frac{1}{6}$$

74. *xyz*

$$\frac{4}{5}\cdot(-15)\cdot\frac{7}{8}=-\left(\frac{4}{5}\cdot\frac{15}{1}\cdot\frac{7}{8}\right)$$
$$=-\frac{4\cdot15\cdot7}{5\cdot1\cdot8}$$
$$=-\frac{2\cdot2\cdot3\cdot5\cdot7}{5\cdot1\cdot2\cdot2\cdot2}$$
$$=-\frac{21}{2}=-10\frac{1}{2}$$

75. *xyz*

$$\frac{5}{6}\cdot(-3)\cdot1\frac{7}{15}=-\left(\frac{5}{6}\cdot\frac{3}{1}\cdot\frac{22}{15}\right)$$
$$=-\frac{5\cdot3\cdot22}{6\cdot1\cdot15}$$
$$=-\frac{5\cdot3\cdot2\cdot11}{2\cdot3\cdot1\cdot3\cdot5}$$
$$=-\frac{11}{3}=-3\frac{2}{3}$$

76. *xyz*

$$4\frac{1}{2}\cdot3\frac{5}{9}\cdot1\frac{7}{8}=\frac{9}{2}\cdot\frac{32}{9}\cdot\frac{15}{8}$$
$$=\frac{9\cdot32\cdot15}{2\cdot9\cdot8}$$
$$=\frac{3\cdot3\cdot2\cdot2\cdot2\cdot2\cdot2\cdot3\cdot5}{2\cdot3\cdot3\cdot2\cdot2\cdot2}$$
$$=\frac{30}{1}=30$$

77.

$$\begin{array}{r|l} \frac{3}{4}y & =-\frac{1}{4} \\ \hline \frac{3}{4}\left(-\frac{1}{3}\right) & -\frac{1}{4} \\ -\frac{3\cdot1}{4\cdot3} & -\frac{1}{4} \\ -\frac{3\cdot1}{2\cdot2\cdot3} & -\frac{1}{4} \end{array}$$
$$-\frac{1}{4}=-\frac{1}{4}$$

Yes, $-\frac{1}{3}$ is a solution of the equation.

78.

$$\begin{array}{r|l} -\frac{5}{6}z & =\frac{1}{3} \\ \hline -\frac{5}{6}\cdot\frac{2}{5} & \frac{1}{3} \\ -\frac{5\cdot2}{6\cdot5} & \frac{1}{3} \\ -\frac{5\cdot2}{2\cdot3\cdot5} & \frac{1}{3} \end{array}$$
$$-\frac{1}{3}\neq\frac{1}{3}$$

No, $\frac{2}{5}$ is not a solution of the equation.

79.

$$\begin{array}{r|l} \frac{4}{5}x & =\frac{5}{3} \\ \hline \frac{4}{5}\cdot\frac{3}{4} & \frac{5}{3} \\ \frac{4\cdot3}{5\cdot4} & \frac{5}{3} \\ \frac{2\cdot2\cdot3}{5\cdot2\cdot2} & \frac{5}{3} \end{array}$$
$$\frac{3}{5}\neq\frac{5}{3}$$

No, $\frac{3}{4}$ is not a solution of the equation.

80.

$$\begin{array}{r|l} \frac{3}{4}p & =\frac{3}{2} \\ \hline \frac{3}{4}\cdot\frac{1}{2} & \frac{3}{2} \\ \frac{3\cdot1}{4\cdot2} & \frac{3}{2} \\ \frac{3\cdot1}{2\cdot2\cdot2} & \frac{3}{2} \end{array}$$
$$\frac{3}{8}\neq\frac{3}{2}$$

No, $\frac{1}{2}$ is not a solution of the equation.

81.

$$\begin{array}{r|l} 6x & =1 \\ \hline 6\left(-\frac{1}{6}\right) & 1 \\ \frac{6}{1}\left(-\frac{1}{6}\right) & 1 \\ -\frac{6\cdot1}{1\cdot6} & 1 \\ -\frac{2\cdot3\cdot1}{1\cdot2\cdot3} & 1 \end{array}$$
$$-1\neq1$$

No, $-\frac{1}{6}$ is not a solution of the equation.

82.
$$\begin{array}{c|c} \multicolumn{2}{c}{\frac{5}{4}n = -1} \\ \hline \frac{5}{4}\left(-\frac{4}{5}\right) & -1 \\ -\frac{5\cdot 4}{4\cdot 5} & -1 \\ -\frac{5\cdot 2\cdot 2}{2\cdot 2\cdot 5} & -1 \\ \multicolumn{2}{c}{-1 = -1} \end{array}$$
Yes, $-\frac{4}{5}$ is a solution of the equation.

Objective B Exercises, pages 202–204

83. $\frac{5}{7} \div \frac{2}{5} = \frac{5}{7}\cdot\frac{5}{2}$
$= \frac{5\cdot 5}{7\cdot 2}$
$= \frac{25}{14} = 1\frac{11}{14}$

84. $\frac{3}{8} \div \frac{2}{3} = \frac{3}{8}\cdot\frac{3}{2}$
$= \frac{3\cdot 3}{8\cdot 2}$
$= \frac{3\cdot 3}{2\cdot 2\cdot 2\cdot 2}$
$= \frac{9}{16}$

85. $\frac{4}{7} \div \left(-\frac{4}{7}\right) = -\left(\frac{4}{7} \div \frac{4}{7}\right)$
$= -\left(\frac{4}{7}\cdot\frac{7}{4}\right)$
$= -\frac{4\cdot 7}{7\cdot 4}$
$= -\frac{2\cdot 2\cdot 7}{7\cdot 2\cdot 2} = -\frac{1}{1} = -1$

86. $\left(-\frac{5}{7}\right) \div \left(-\frac{5}{6}\right) = \frac{5}{7} \div \frac{5}{6}$
$= \frac{5}{7}\cdot\frac{6}{5}$
$= \frac{5\cdot 6}{7\cdot 5}$
$= \frac{5\cdot 2\cdot 3}{7\cdot 5} = \frac{6}{7}$

87. $0 \div \frac{7}{9} = 0\cdot\frac{9}{7} = 0$
Zero divided by a non-zero number is 0.

88. $0 \div \frac{4}{5} = 0\cdot\frac{5}{4} = 0$
Zero divided by a non-zero number is 0.

89. $\left(-\frac{1}{3}\right) \div \frac{1}{2} = -\left(\frac{1}{3} \div \frac{1}{2}\right)$
$= -\left(\frac{1}{3}\cdot\frac{2}{1}\right)$
$= -\frac{1\cdot 2}{3\cdot 1} = -\frac{2}{3}$

90. $\left(-\frac{3}{8}\right) \div \frac{7}{8} = -\left(\frac{3}{8} \div \frac{7}{8}\right)$
$= -\left(\frac{3}{8}\cdot\frac{8}{7}\right)$
$= -\frac{3\cdot 8}{8\cdot 7}$
$= -\frac{3\cdot 2\cdot 2\cdot 2}{2\cdot 2\cdot 2\cdot 7}$
$= -\frac{3}{7}$

91. $-\frac{5}{16} \div \left(-\frac{3}{8}\right) = \frac{5}{16} \div \frac{3}{8}$
$= \frac{5}{16}\cdot\frac{8}{3}$
$= \frac{5\cdot 8}{16\cdot 3}$
$= \frac{5\cdot 2\cdot 2\cdot 2}{2\cdot 2\cdot 2\cdot 2\cdot 3}$
$= \frac{5}{6}$

92. $\left(-\frac{3}{4}\right) \div \left(-\frac{5}{6}\right) = \frac{3}{4} \div \frac{5}{6}$
$= \frac{3}{4}\cdot\frac{6}{5}$
$= \frac{3\cdot 6}{4\cdot 5}$
$= \frac{3\cdot 2\cdot 3}{2\cdot 2\cdot 5}$
$= \frac{9}{10}$

93. $\frac{0}{1} \div \frac{1}{9} = \frac{0}{1}\cdot\frac{9}{1}$
$= \frac{0\cdot 9}{1\cdot 1}$
$= \frac{0}{1} = 0$

94. $\frac{1}{2} \div \left(-\frac{8}{0}\right)$
Division by zero is undefined in $-\frac{8}{0}$.

95. $6 \div \frac{3}{4} = \frac{6}{1}\cdot\frac{4}{3}$
$= \frac{6\cdot 4}{1\cdot 3}$
$= \frac{2\cdot 3\cdot 2\cdot 2}{1\cdot 3}$
$= \frac{8}{1} = 8$

96. $8 \div \frac{2}{3} = \frac{8}{1} \cdot \frac{3}{2}$
$= \frac{8 \cdot 3}{1 \cdot 2}$
$= \frac{2 \cdot 2 \cdot 2 \cdot 3}{1 \cdot 2}$
$= \frac{12}{1} = 12$

97. $\frac{3}{4} \div (-6) = -\left(\frac{3}{4} \div \frac{6}{1}\right)$
$= -\left(\frac{3}{4} \cdot \frac{1}{6}\right)$
$= -\frac{3 \cdot 1}{4 \cdot 6}$
$= -\frac{3 \cdot 1}{2 \cdot 2 \cdot 2 \cdot 3}$
$= -\frac{1}{8}$

98. $-\frac{2}{3} \div 8 = -\left(\frac{2}{3} \div \frac{8}{1}\right)$
$= -\left(\frac{2}{3} \cdot \frac{1}{8}\right)$
$= -\frac{2 \cdot 1}{3 \cdot 8}$
$= -\frac{2 \cdot 1}{3 \cdot 2 \cdot 2 \cdot 2}$
$= -\frac{1}{12}$

99. $\frac{9}{10} \div 0$
Division by zero is undefined.

100. $\frac{2}{11} \div 0$
Division by zero is undefined.

101. $\frac{5}{12} \div \left(-\frac{15}{32}\right) = -\left(\frac{5}{12} \div \frac{15}{32}\right)$
$= -\left(\frac{5}{12} \cdot \frac{32}{15}\right)$
$= -\frac{5 \cdot 32}{12 \cdot 15}$
$= -\frac{5 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2}{2 \cdot 2 \cdot 3 \cdot 3 \cdot 5}$
$= -\frac{8}{9}$

102. $\frac{3}{8} \div \left(-\frac{5}{12}\right) = -\left(\frac{3}{8} \div \frac{5}{12}\right)$
$= -\left(\frac{3}{8} \cdot \frac{12}{5}\right)$
$= -\frac{3 \cdot 12}{8 \cdot 5}$
$= -\frac{3 \cdot 2 \cdot 2 \cdot 3}{2 \cdot 2 \cdot 2 \cdot 5}$
$= -\frac{9}{10}$

103. $\left(-\frac{2}{3}\right) \div (-4) = \frac{2}{3} \div \frac{4}{1}$
$= \frac{2}{3} \cdot \frac{1}{4}$
$= \frac{2 \cdot 1}{3 \cdot 4}$
$= \frac{2 \cdot 1}{3 \cdot 2 \cdot 2}$
$= \frac{1}{6}$

104. $\left(-\frac{4}{9}\right) \div (-6) = \frac{4}{9} \div \frac{6}{1}$
$= \frac{4}{9} \cdot \frac{1}{6}$
$= \frac{4 \cdot 1}{9 \cdot 6}$
$= \frac{2 \cdot 2 \cdot 1}{3 \cdot 3 \cdot 2 \cdot 3}$
$= \frac{2}{27}$

105. $\frac{8}{x} \div \left(-\frac{y}{4}\right) = -\left(\frac{8}{x} \div \frac{y}{4}\right)$
$= -\left(\frac{8}{x} \cdot \frac{4}{y}\right)$
$= -\frac{8 \cdot 4}{x \cdot y}$
$= -\frac{32}{xy}$

106. $-\frac{9}{m} \div \frac{n}{7} = -\left(\frac{9}{m} \div \frac{n}{7}\right)$
$= -\left(\frac{9}{m} \cdot \frac{7}{n}\right)$
$= -\frac{9 \cdot 7}{m \cdot n}$
$= -\frac{63}{mn}$

107. $\frac{b}{6} \div \frac{5}{d} = \frac{b}{6} \cdot \frac{d}{5}$
$= \frac{b \cdot d}{6 \cdot 5}$
$= \frac{bd}{30}$

108. $\frac{y}{10} \div \frac{4}{z} = \frac{y}{10} \cdot \frac{z}{4}$
$= \frac{y \cdot z}{10 \cdot 4}$
$= \frac{yz}{40}$

109. $3\frac{1}{3} \div \frac{5}{8} = \frac{10}{3} \cdot \frac{8}{5} = \frac{10 \cdot 8}{3 \cdot 5}$
$= \frac{2 \cdot 5 \cdot 2 \cdot 2 \cdot 2}{3 \cdot 5}$
$= \frac{16}{3} = 5\frac{1}{3}$

110. $5\frac{1}{2} \div \frac{1}{4} = \frac{11}{2} \cdot \frac{4}{1}$
$= \frac{11 \cdot 4}{2 \cdot 1}$
$= \frac{11 \cdot 2 \cdot 2}{2 \cdot 1}$
$= \frac{22}{1} = 22$

111. $5\frac{3}{5} \div \left(-\frac{7}{10}\right) = -\left(\frac{28}{5} \div \frac{7}{10}\right)$
$= -\left(\frac{28}{5} \cdot \frac{10}{7}\right)$
$= -\frac{28 \cdot 10}{5 \cdot 7}$
$= -\frac{2 \cdot 2 \cdot 7 \cdot 2 \cdot 5}{5 \cdot 7}$
$= -\frac{8}{1} = -8$

112. $6\frac{8}{9} \div \left(-\frac{31}{36}\right) = -\left(\frac{62}{9} \div \frac{31}{36}\right)$
$= -\left(\frac{62}{9} \cdot \frac{36}{31}\right)$
$= -\frac{62 \cdot 36}{9 \cdot 31}$
$= -\frac{2 \cdot 31 \cdot 2 \cdot 2 \cdot 3 \cdot 3}{3 \cdot 3 \cdot 31}$
$= -\frac{8}{1} = -8$

113. $-1\frac{1}{2} \div 1\frac{3}{4} = -\left(\frac{3}{2} \div \frac{7}{4}\right)$
$= -\left(\frac{3}{2} \cdot \frac{4}{7}\right)$
$= -\frac{3 \cdot 4}{2 \cdot 7}$
$= -\frac{3 \cdot 2 \cdot 2}{2 \cdot 7}$
$= -\frac{6}{7}$

114. $-1\frac{3}{5} \div 3\frac{1}{10} = -\left(\frac{8}{5} \div \frac{31}{10}\right)$
$= -\left(\frac{8}{5} \cdot \frac{10}{31}\right)$
$= -\frac{8 \cdot 10}{5 \cdot 31}$
$= -\frac{2 \cdot 2 \cdot 2 \cdot 2 \cdot 5}{5 \cdot 31}$
$= -\frac{16}{31}$

115. $5\frac{1}{2} \div 11 = \frac{11}{2} \div \frac{11}{1}$
$= \frac{11}{2} \cdot \frac{1}{11}$
$= \frac{11 \cdot 1}{2 \cdot 11}$
$= \frac{1}{2}$

116. $4\frac{2}{3} \div 7 = \frac{14}{3} \div \frac{7}{1}$
$= \frac{14}{3} \cdot \frac{1}{7}$
$= \frac{14 \cdot 1}{3 \cdot 7}$
$= \frac{2 \cdot 7 \cdot 1}{3 \cdot 7}$
$= \frac{2}{3}$

117. $5\frac{2}{7} \div 1 = \frac{37}{7} \div \frac{1}{1}$
$= \frac{37}{7} \cdot \frac{1}{1}$
$= \frac{37 \cdot 1}{7 \cdot 1}$
$= \frac{37}{7} = 5\frac{2}{7}$

118. $9\frac{5}{6} \div 1 = \frac{59}{6} \div \frac{1}{1}$
$= \frac{59}{6} \cdot \frac{1}{1}$
$= \frac{59 \cdot 1}{6 \cdot 1}$
$= \frac{59}{6} = 9\frac{5}{6}$

119. $-16 \div 1\frac{1}{3} = -\left(\frac{16}{1} \div \frac{4}{3}\right)$
$= -\left(\frac{16}{1} \cdot \frac{3}{4}\right)$
$= -\frac{16 \cdot 3}{1 \cdot 4}$
$= -\frac{2 \cdot 2 \cdot 2 \cdot 2 \cdot 3}{1 \cdot 2 \cdot 2}$
$= -\frac{12}{1} = -12$

120. $-9 \div \left(-3\frac{3}{5}\right) = \frac{9}{1} \div \frac{18}{5}$
$= \frac{9}{1} \cdot \frac{5}{18}$
$= \frac{9 \cdot 5}{1 \cdot 18}$
$= \frac{3 \cdot 3 \cdot 5}{1 \cdot 2 \cdot 3 \cdot 3}$
$= \frac{5}{2} = 2\frac{1}{2}$

121. $2\frac{4}{13} \div 1\frac{5}{26} = \frac{30}{13} \div \frac{31}{26}$
$= \frac{30}{13} \cdot \frac{26}{31}$
$= \frac{30 \cdot 26}{13 \cdot 31}$
$= \frac{2 \cdot 3 \cdot 5 \cdot 2 \cdot 13}{13 \cdot 31}$
$= \frac{60}{31} = 1\frac{29}{31}$

122. $3\frac{3}{8} \div 2\frac{7}{16} = \frac{27}{8} \div \frac{39}{16}$
$= \frac{27}{8} \cdot \frac{16}{39}$
$= \frac{27 \cdot 16}{8 \cdot 39}$
$= \frac{3 \cdot 3 \cdot 3 \cdot 2 \cdot 2 \cdot 2 \cdot 2}{2 \cdot 2 \cdot 2 \cdot 3 \cdot 13}$
$= \frac{18}{13} = 1\frac{5}{13}$

123. $\frac{9}{10} \div \frac{3}{4} = \frac{9}{10} \cdot \frac{4}{3}$
$= \frac{9 \cdot 4}{10 \cdot 3}$
$= \frac{3 \cdot 3 \cdot 2 \cdot 2}{2 \cdot 5 \cdot 3}$
$= \frac{6}{5} = 1\frac{1}{5}$

124. $\frac{3}{5} \div \frac{12}{25} = \frac{3}{5} \cdot \frac{25}{12}$
$= \frac{3 \cdot 25}{5 \cdot 12}$
$= \frac{3 \cdot 5 \cdot 5}{5 \cdot 2 \cdot 2 \cdot 3}$
$= \frac{5}{4} = 1\frac{1}{4}$

125. $\left(-\frac{15}{24}\right) \div \frac{3}{5} = -\left(\frac{15}{24} \cdot \frac{5}{3}\right)$
$= -\frac{15 \cdot 5}{24 \cdot 3}$
$= -\frac{3 \cdot 5 \cdot 5}{2 \cdot 2 \cdot 2 \cdot 3 \cdot 3}$
$= -\frac{25}{24} = -1\frac{1}{24}$

126. $\frac{5}{6} \div \left(-\frac{10}{21}\right) = -\left(\frac{5}{6} \div \frac{10}{21}\right)$
$= -\left(\frac{5}{6} \cdot \frac{21}{10}\right)$
$= -\frac{5 \cdot 21}{6 \cdot 10}$
$= -\frac{5 \cdot 3 \cdot 7}{2 \cdot 3 \cdot 2 \cdot 5}$
$= -\frac{7}{4} = -1\frac{3}{4}$

127. $\frac{7}{8} \div 3\frac{1}{4} = \frac{7}{8} \div \frac{13}{4}$
$= \frac{7}{8} \cdot \frac{4}{13}$
$= \frac{7 \cdot 4}{8 \cdot 13}$
$= \frac{7 \cdot 2 \cdot 2}{2 \cdot 2 \cdot 2 \cdot 13}$
$= \frac{7}{26}$

128. $-\frac{3}{8} \div 2\frac{1}{4} = -\left(\frac{3}{8} \div \frac{9}{4}\right)$
$= -\left(\frac{3}{8} \cdot \frac{4}{9}\right)$
$= -\frac{3 \cdot 4}{8 \cdot 9}$
$= -\frac{3 \cdot 2 \cdot 2}{2 \cdot 2 \cdot 2 \cdot 3 \cdot 3}$
$= -\frac{1}{6}$

129. $-3\frac{5}{11} \div 3\frac{4}{5} = -\left(\frac{38}{11} \div \frac{19}{5}\right)$
$= -\left(\frac{38}{11} \cdot \frac{5}{19}\right)$
$= -\frac{38 \cdot 5}{11 \cdot 19}$
$= -\frac{2 \cdot 19 \cdot 5}{11 \cdot 19}$
$= -\frac{10}{11}$

130. $-10\frac{1}{5} \div \left(-1\frac{7}{10}\right) = \frac{51}{5} \div \frac{17}{10}$
$= \frac{51}{5} \cdot \frac{10}{17}$
$= \frac{51 \cdot 10}{5 \cdot 17}$
$= \frac{3 \cdot 17 \cdot 2 \cdot 5}{5 \cdot 17}$
$= \frac{6}{1} = 6$

131. $x \div y$

$-\frac{5}{8} \div \left(-\frac{15}{2}\right) = \frac{5}{8} \div \frac{15}{2}$

$= \frac{5}{8} \cdot \frac{2}{15}$

$= \frac{5 \cdot 2}{8 \cdot 15}$

$= \frac{5 \cdot 2}{2 \cdot 2 \cdot 2 \cdot 3 \cdot 5}$

$= \frac{1}{12}$

132. $x \div y$

$-\frac{14}{3} \div \left(-\frac{7}{9}\right) = \frac{14}{3} \div \frac{7}{9}$

$= \frac{14}{3} \cdot \frac{9}{7}$

$= \frac{14 \cdot 9}{3 \cdot 7}$

$= \frac{2 \cdot 7 \cdot 3 \cdot 3}{3 \cdot 7}$

$= \frac{6}{1} = 6$

133. $x \div y$

$\frac{1}{7} \div 0$

Division by zero is undefined.

134. $x \div y$

$\frac{0}{4} \div 12$

Division by zero is undefined.

135. $x \div y$

$-18 \div \frac{3}{8} = -\left(\frac{18}{1} \cdot \frac{8}{3}\right)$

$= -\frac{18 \cdot 8}{1 \cdot 3}$

$= -\frac{2 \cdot 3 \cdot 3 \cdot 2 \cdot 2 \cdot 2}{1 \cdot 3}$

$= -\frac{48}{1} = -48$

136. $x \div y$

$20 \div \left(-\frac{5}{6}\right) = -\left(\frac{20}{1} \div \frac{5}{6}\right)$

$= -\left(\frac{20}{1} \cdot \frac{6}{5}\right)$

$= -\frac{20 \cdot 6}{1 \cdot 5}$

$= -\frac{2 \cdot 2 \cdot 5 \cdot 2 \cdot 3}{1 \cdot 5}$

$= -\frac{24}{1} = -24$

137. $x \div y$

$-\frac{1}{2} \div \left(-3\frac{5}{8}\right) = \frac{1}{2} \div \frac{29}{8}$

$= \frac{1}{2} \cdot \frac{8}{29}$

$= \frac{1 \cdot 8}{2 \cdot 29}$

$= \frac{1 \cdot 2 \cdot 2 \cdot 2}{2 \cdot 29}$

$= \frac{4}{29}$

138. $x \div y$

$4\frac{3}{8} \div 7 = \frac{35}{8} \div \frac{7}{1}$

$= \frac{35}{8} \cdot \frac{1}{7}$

$= \frac{35 \cdot 1}{8 \cdot 7}$

$= \frac{5 \cdot 7 \cdot 1}{2 \cdot 2 \cdot 2 \cdot 7}$

$= \frac{5}{8}$

139. $x \div y$

$6\frac{2}{5} \div (-4) = -\left(\frac{32}{5} \div \frac{4}{1}\right)$

$= -\left(\frac{32}{5} \cdot \frac{1}{4}\right)$

$= -\frac{32 \cdot 1}{5 \cdot 4}$

$= -\frac{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 1}{5 \cdot 2 \cdot 2}$

$= -\frac{8}{5} = -1\frac{3}{5}$

140. $x \div y$

$-2\frac{5}{8} \div 1\frac{3}{4} = -\left(\frac{21}{8} \div \frac{7}{4}\right)$

$= -\left(\frac{21}{8} \cdot \frac{4}{7}\right)$

$= -\frac{21 \cdot 4}{8 \cdot 7}$

$= -\frac{3 \cdot 7 \cdot 2 \cdot 2}{2 \cdot 2 \cdot 2 \cdot 7}$

$= -\frac{3}{2} = -1\frac{1}{2}$

141. $x \div y$

$-3\frac{2}{5} \div \left(-1\frac{7}{10}\right) = \frac{17}{5} \div \frac{17}{10}$

$= \frac{17}{5} \cdot \frac{10}{17}$

$= \frac{17 \cdot 10}{5 \cdot 17}$

$= \frac{17 \cdot 2 \cdot 5}{5 \cdot 17}$

$= \frac{2}{1} = 2$

142. $x \div y$

$$-5\frac{2}{5} \div (-9) = -\frac{27}{5} \div \frac{9}{1}$$
$$= -\frac{27}{5} \cdot \frac{1}{9}$$
$$= -\frac{27 \cdot 1}{5 \cdot 9}$$
$$= -\frac{3 \cdot 3 \cdot 3 \cdot 1}{5 \cdot 3 \cdot 3}$$
$$= -\frac{3}{5}$$

143. Strategy To find the number of servings, divide the net weight of Kellogg Honey Crunch Corn Flakes (24) by $\frac{3}{4}$.

Solution $24 \div \frac{3}{4} = \frac{24}{1} \cdot \frac{4}{3} = \frac{24 \cdot 4}{1 \cdot 3} = 32$

There are 32 servings in a box of Kellogg Honey Crunch Corn Flakes.

144. Strategy To find the number of servings, divide the net weight of Shredded Wheat (18) by $1\frac{1}{4}$.

Solution $18 \div 1\frac{1}{4} = \frac{18}{1} \div \frac{5}{4} = \frac{18}{1} \cdot \frac{4}{5} = \frac{18 \cdot 4}{1 \cdot 5} = 14\frac{2}{5}$

There are $14\frac{2}{5}$ servings in a box of Shredded Wheat.

Objective C Exercises, pages 204–206

145. Strategy To find the length of time, multiply the length of time for one chukker $\left(7\frac{1}{2}\right)$ by 4.

Solution $7\frac{1}{2} \cdot 4 = \frac{15}{2} \cdot \frac{4}{1} = \frac{15 \cdot 4}{2 \cdot 1} = 30$

Four periods of play takes 30 min.

146. Strategy To find the number of days, multiply the number of days in one lunation $\left(29\frac{1}{2}\right)$ by 12.

Solution $29\frac{1}{2} \cdot 12 = \frac{59}{2} \cdot \frac{12}{1} = \frac{59 \cdot 12}{2 \cdot 1} = 354$

There are 354 days in one year of the Assyrian calendar.

147. Strategy →To find the number of feet in one rod, multiply the number of yards in one rod $\left(5\frac{1}{2}\right)$ by 3.

→To find the number of inches in one rod, multiply the number of yards in one rod $\left(5\frac{1}{2}\right)$ by 36.

Solution $5\frac{1}{2}\cdot 3=\frac{11}{2}\cdot\frac{3}{1}=\frac{11\cdot 3}{2\cdot 1}=16\frac{1}{2}$

$5\frac{1}{2}\cdot 36=\frac{11}{2}\cdot\frac{36}{1}=\frac{11\cdot 36}{2\cdot 1}=198$

One rod is equivalent to $16\frac{1}{2}$ ft.

One rod is equivalent to 198 in.

148. Strategy To find the number of miles traveled, divide the number of miles (275) by the number of gallons used $\left(12\frac{1}{2}\right)$.

Solution $275\div 12\frac{1}{2}=\frac{275}{1}\div\frac{25}{2}=\frac{275}{1}\cdot\frac{2}{25}=22$

The car can travel 22 mi on 1 gal of gas.

149. Strategy To find the amount of time, multiply the number of hours cleaning per week $\left(4\frac{1}{2}\right)$ by the number of weeks (52).

Solution $4\frac{1}{2}\cdot 52=\frac{9}{2}\cdot\frac{52}{1}=\frac{9\cdot 52}{2\cdot 1}=234$

The average couple spends 234 h a year cleaning house.

150. Strategy To find the number of products, divide the number of minutes in one hour (60) by the time to assemble one product $\left(7\frac{1}{2}\right)$.

Solution $60\div 7\frac{1}{2}=\frac{60}{1}\div\frac{15}{2}=\frac{60}{1}\cdot\frac{2}{15}=\frac{60\cdot 2}{1\cdot 15}=8$

The factory worker can assemble 8 products in one hour.

151. Strategy To find the number of house plots:

→Subtract the number of acres set aside (3) from the total number of acres $\left(25\frac{1}{2}\right)$ to find the number of acres to be sold in parcels.

→Divide the number of acres available by the number of acres in one parcel $\left(\frac{3}{4}\right)$.

Solution $25\frac{1}{2}-3=22\frac{1}{2}$

$22\frac{1}{2}\div\frac{3}{4}=\frac{45}{2}\cdot\frac{4}{3}=\frac{45\cdot 4}{2\cdot 3}=30$

The developer plans to build 30 houses.

152. Strategy To find the amount of hamburger meat, multiply the number of hamburgers per person (2) by the weight of each hamburger $\left(\frac{1}{4}\right)$ by the number of guests (25).

Solution $2 \cdot \frac{1}{4} \cdot 25 = \frac{2}{1} \cdot \frac{1}{4} \cdot \frac{25}{1} = 12\frac{1}{2}$

You should buy $12\frac{1}{2}$ lb of hamburger.

153. Strategy To find the dimensions of the board, divide one side (14) by 2 and multiply the thickness $\left(\frac{7}{8}\right)$ by 2.

Solution $14 \div 2 = 7$

$\frac{7}{8} \cdot 2 = \frac{7}{8} \cdot \frac{2}{1} = 1\frac{3}{4}$

The dimensions when the board is closed are 14 in. by 7 in. by $1\frac{3}{4}$ in.

154. Strategy To find the length of the remaining piece:

→Divide the total length (16) by the length of each shelf $\left(2\frac{1}{2}\right)$. The answer is the number of shelves cut with a certain fraction of a shelf left over.

→Multiply the fraction left over by the length of a shelf to determine the length of the piece remaining.

Solution $16 \div 2\frac{1}{2} = \frac{16}{1} \div \frac{5}{2} = \frac{16}{1} \cdot \frac{2}{5} = \frac{16 \cdot 2}{1 \cdot 5} = 6\frac{2}{5}$

$\frac{2}{5} \cdot 2\frac{1}{2} = \frac{2}{5} \cdot \frac{5}{2} = \frac{2 \cdot 5}{5 \cdot 2} = 1$

The length of the piece remaining is 1 ft.

155. Strategy To find the earnings, multiply the earnings for one hour's work (12) by the number of hours $\left(26\frac{1}{2}\right)$.

Solution $12 \cdot 26\frac{1}{2} = \frac{12}{1} \cdot \frac{53}{2} = \frac{12 \cdot 53}{1 \cdot 2} = 318$

The total of the employee's earnings is $318.

156. Strategy

a. To find the cost, multiply the Hilton Hotels stock price $\left(8\frac{5}{8}\right)$ by 200.

b. To find the price, multiply the Four Seasons stock price $\left(62\frac{1}{4}\right)$ by 300.

c. To find the cost, multiply the Marriott stock price $\left(36\frac{1}{16}\right)$ by 400.

d. To find the cost, subtract the cost of 1,000 shares of MGM Grand from the cost of 1,000 shares of

→Multiply the Four Seasons stock price $\left(62\frac{1}{4}\right)$ by 1,000 to find the cost.

→Multiply the MGM Grand stock price $\left(33\frac{1}{2}\right)$ by 1,000 to find the cost.

→Subtract the cost of 1,000 share of MGM Grand from the cost of 1,000 shares of Four Seasons.

Solution

a. $8\frac{5}{8}\cdot 200=\frac{69}{8}\cdot\frac{200}{1}=1{,}725$

It would cost $1,725 for 200 shares of Hilton Hotels.

b. $62\frac{1}{4}\cdot 300=\frac{249}{4}\cdot\frac{300}{1}=18{,}675$

The price of 300 shares of Four Seasons is $18,675.

c. $36\frac{1}{16}\cdot 400=\frac{577}{16}\cdot\frac{400}{1}=14{,}425$

It would cost $14,425 for 400 shares of Marriott.

d. $62\frac{1}{4}\cdot 1{,}000=\frac{249}{4}\cdot\frac{1{,}000}{1}=62{,}250$

$33\frac{1}{2}\cdot 1{,}000=\frac{67}{2}\cdot\frac{1{,}000}{1}=33{,}500$

$62{,}250-33{,}500=28{,}750$

It would cost $28,750 more to buy 1,000 shares of Four Seasons than 1,000 shares of MGM Grand.

157. Strategy To find the area, use the formula below, substitute $8\frac{1}{2}$ for L, 5 for W, and solve for A.

Solution $A=LW$

$$A=8\frac{1}{2}\cdot 5=\frac{17}{2}\cdot\frac{5}{1}$$

$$=\frac{85}{2}=42\frac{1}{2}$$

The area of the rectangle is $42\frac{1}{2}$ yd^2.

158. Strategy To find the area, use the formula below, substitute $3\frac{1}{4}$ for L, $1\frac{1}{2}$ for W, and solve for A.

Solution $A = LW$

$$A = 3\frac{1}{4}\cdot 1\frac{1}{2} = \frac{13}{4}\cdot\frac{3}{2}$$
$$= \frac{39}{8} = 4\frac{7}{8}$$

The area of the rectangle is $4\frac{7}{8}$ mi^2.

159. Strategy To find the area, use the formula below, substitute 12 for b, 16 for h, and solve for A.

Solution $A = \frac{1}{2}bh$

$$A = \frac{1}{2}\cdot 12\cdot 16 = \frac{1}{2}\cdot\frac{12}{1}\cdot\frac{16}{1} = 96$$

The amount of canvas needed for the sail is 96 m^2.

160. Strategy To find the area, use the formula below, substitute 21 for b, 13 for h, and solve for A.

Solution $A = \frac{1}{2}bh$

$$A = \frac{1}{2}\cdot 21\cdot 13 = \frac{1}{2}\cdot\frac{21}{1}\cdot\frac{13}{1}$$
$$= \frac{651}{2} = 136\frac{1}{2}$$

The area of the vegetable garden is $136\frac{1}{2}$ ft^2.

161. Strategy To find the number of bags of seed:
→Find the area of the triangle, use the formula below, substitute 20 for b, 24 for h, and solve for A.
→Divide the area by 120.

Solution $A = \frac{1}{2}bh$

$$A = \frac{1}{2}\cdot 20\cdot 24 = \frac{1}{2}\cdot\frac{20}{1}\cdot\frac{24}{1} = 240$$

$240 \div 120 = 2$

Two bags of grass seed should be purchased.

162. Strategy To find the pressure, substitute $12\frac{1}{2}$ for D in the given formula and solve for P.

Solution
$$P = 15 + \frac{1}{2}D$$
$$P = 15 + \frac{1}{2}\left(12\frac{1}{2}\right)$$
$$P = 15 + \frac{1}{2}\left(\frac{25}{2}\right)$$
$$P = 15 + 6\frac{1}{4}$$
$$P = 21\frac{1}{4}$$
The pressure is $21\frac{1}{4}$ pounds per square inch.

163. Strategy To find the rate, substitute $4\frac{2}{3}$ for d and $1\frac{1}{3}$ for t in the given formula and solve for r.

Solution
$$r = \frac{d}{t}$$
$$r = \frac{4\frac{2}{3}}{1\frac{1}{3}} = 4\frac{2}{3} \div 1\frac{1}{3}$$
$$r = \frac{14}{3} \div \frac{4}{3}$$
$$r = \frac{14}{3} \cdot \frac{3}{4} = \frac{14 \cdot 3}{3 \cdot 4} = 3\frac{1}{2}$$
The rate of the hiker is $3\frac{1}{2}$ mph.

164. Strategy To find the amount of force, substitute $\frac{3}{8}$ for μ and 75 for N in the given formula and solve for F.

Solution
$$F = \mu N$$
$$F = \frac{3}{8} \cdot 75 = \frac{3}{8} \cdot \frac{75}{1}$$
$$F = \frac{3 \cdot 75}{8 \cdot 1} = 28\frac{1}{8}$$
It takes $28\frac{1}{8}$ lb of force to push the crate.

Critical Thinking 3.4, page 206

165. Divide $3\frac{1}{8}$ by $\frac{1}{8}$ to find the number of 50-mile segments between the two cities.
$$3\frac{1}{8} \div \frac{1}{8} = \frac{25}{8} \div \frac{1}{8} = \frac{25}{8} \cdot \frac{8}{1} = 25$$
Multiply 25 times 50 to find the number of miles.
$25 \cdot 50 = 1{,}250$
The distance between the two cities is 1,250 mi.

166. **a.** If n is a positive even integer, $\frac{1}{2}$ is a whole number. If n is negative even integer, $\frac{1}{2}n$ is not a whole number. The statement is sometimes true.

b. If $n = 3$, n is an odd number and $\frac{1}{2}n = \frac{1}{2}\cdot 3 = \frac{3}{2}$, which is an improper fraction. If $n = 1$, n is an odd number, but $\frac{1}{2}n = \frac{1}{2}\cdot 1 = \frac{1}{2}$, which is not an improper fraction. The statement is sometimes true.

167. **a.** Commutative Property

$\frac{1}{2} \div \frac{1}{4} = \frac{1}{2}\cdot\frac{4}{1} = 2$

$\frac{1}{4} \div \frac{1}{2} = \frac{1}{4}\cdot\frac{2}{1} = \frac{1}{2}$

$\frac{1}{2} \div \frac{1}{4} \neq \frac{1}{4} \div \frac{1}{2}$

b. Associative Property

$\frac{1}{2} \div \left(\frac{1}{4} \div \frac{1}{8}\right) = \frac{1}{2} \div \left(\frac{1}{4}\cdot\frac{8}{1}\right) = \frac{1}{2} \div 2 = \frac{1}{2}\cdot\frac{1}{2} = \frac{1}{4}$

$\left(\frac{1}{2} \div \frac{1}{4}\right) \div \frac{1}{8} = \left(\frac{1}{2}\cdot\frac{4}{1}\right) \div \frac{1}{8} = 2 \div \frac{1}{8} = 2\cdot 8 = 16$

$\frac{1}{2} \div \left(\frac{1}{4} \div \frac{1}{8}\right) \neq \left(\frac{1}{2} \div \frac{1}{4}\right) \div \frac{1}{8}$

c. Inverse Property

$7 \div \frac{1}{7} = 7\cdot 7 = 49 \neq 1$

Section 3.5

Objective A Exercises, page 211

1. $\frac{x}{4} = 9$

$4\cdot\frac{x}{4} = 4\cdot 9$

$x = 36$

The solution is 36.

2. $8 = \frac{y}{2}$

$2\cdot 8 = 2\cdot\frac{y}{2}$

$16 = y$

The solution is 16.

3. $-3 = \frac{m}{4}$

$4(-3) = 4\cdot\frac{m}{4}$

$-12 = m$

The solution is -12.

4. $\frac{n}{5} = -2$

$5\cdot\frac{n}{5} = 5(-2)$

$n = -10$

The solution is -10.

5. $\frac{2}{5}x = 10$

$\frac{5}{2}\cdot\frac{2}{5}x = \frac{5}{2}\cdot 10$

$x = 25$

The solution is 25.

6. $\frac{3}{4}z = 12$

$\frac{4}{3}\cdot\frac{3}{4}z = \frac{4}{3}\cdot 12$

$z = 16$

The solution is 16.

7. $-\frac{5}{6}w = 10$

$-\frac{6}{5}\left(-\frac{5}{6}\right)w = -\frac{6}{5}(10)$

$w = -12$

The solution is -12.

8. $-\frac{1}{2}x = 3$

$-2\left(-\frac{1}{2}\right)x = -2(3)$

$x = -6$

The solution is -6.

9. $\frac{1}{4}+y=\frac{3}{4}$

$\frac{1}{4}-\frac{1}{4}+y=\frac{3}{4}-\frac{1}{4}$

$y=\frac{2}{4}$

$y=\frac{1}{2}$

The solution is $\frac{1}{2}$.

10. $\frac{5}{9}=t-\frac{1}{9}$

$\frac{5}{9}+\frac{1}{9}=t-\frac{1}{9}+\frac{1}{9}$

$\frac{6}{9}=t$

$\frac{2}{3}=t$

The solution is $\frac{2}{3}$.

11. $x+\frac{1}{4}=\frac{5}{6}$

$x=\frac{1}{4}-\frac{1}{4}=\frac{5}{6}-\frac{1}{4}$

$x=\frac{10}{12}-\frac{3}{12}$

$x=\frac{7}{12}$

The solution is $\frac{7}{12}$.

12. $\frac{7}{8}=y-\frac{1}{6}$

$\frac{7}{8}+\frac{1}{6}=y-\frac{1}{6}+\frac{1}{6}$

$\frac{21}{24}+\frac{4}{24}=y$

$\frac{25}{24}=y$

$1\frac{1}{24}=y$

The solution is $1\frac{1}{24}$.

13. $-\frac{2x}{3}=-\frac{1}{2}$

$-\frac{3}{2}\left(-\frac{2}{3}x\right)=-\frac{3}{2}\left(-\frac{1}{2}\right)$

$x=\frac{3}{4}$

The solution is $\frac{3}{4}$.

14. $-\frac{4a}{5}=\frac{2}{3}$

$-\frac{5}{4}\left(-\frac{4}{5}a\right)=-\frac{5}{4}\left(\frac{2}{3}\right)$

$a=-\frac{5}{6}$

The solution is $-\frac{5}{6}$.

15. $\frac{5n}{6}=-\frac{2}{3}$

$\frac{6}{5}\left(\frac{5}{6}n\right)=\frac{6}{5}\left(-\frac{2}{3}\right)$

$n=-\frac{4}{5}$

The solution is $-\frac{4}{5}$.

16. $\frac{7z}{8}=-\frac{5}{16}$

$\frac{8}{7}\left(\frac{7}{8}z\right)=\frac{8}{7}\left(-\frac{5}{16}\right)$

$z=-\frac{5}{14}$

The solution is $-\frac{5}{14}$.

17. $-\frac{3}{8}t=-\frac{1}{4}$

$-\frac{8}{3}\left(-\frac{3}{8}t\right)=-\frac{8}{3}\left(-\frac{1}{4}\right)$

$t=\frac{2}{3}$

The solution is $\frac{2}{3}$.

18. $-\frac{3}{4}t=-\frac{7}{8}$

$-\frac{4}{3}\left(-\frac{3}{4}t\right)=-\frac{4}{3}\left(-\frac{7}{8}\right)$

$t=\frac{7}{6}$

$t=1\frac{1}{6}$

The solution is $1\frac{1}{6}$.

19. $4a=6$

$\frac{4a}{4}=\frac{6}{4}$

$a=\frac{3}{2}$

$a=1\frac{1}{2}$

The solution is $1\frac{1}{2}$.

20. $6z = 10$

$\frac{6z}{6} = \frac{10}{6}$

$z = \frac{5}{3}$

$z = 1\frac{2}{3}$

The solution is $1\frac{2}{3}$.

21. $-9c = 12$

$\frac{-9c}{-9} = \frac{12}{-9}$

$c = -\frac{4}{3}$

$c = -1\frac{1}{3}$

The solution is $-1\frac{1}{3}$.

22. $-10z = 28$

$\frac{-10z}{-10} = \frac{28}{-10}$

$z = -\frac{14}{5}$

$s = -2\frac{4}{5}$

The solution is $-2\frac{4}{5}$.

23. $-2x = \frac{8}{9}$

$\frac{-2x}{-2} = \frac{8}{9} \div (-2)$

$x = -\left(\frac{8}{9} \cdot \frac{1}{2}\right)$

$x = -\frac{4}{9}$

The solution is $-\frac{4}{9}$.

24. $-5y = -\frac{15}{16}$

$\frac{-5y}{-5} = -\frac{15}{16} \div (-5)$

$y = \frac{15}{16} \cdot \frac{1}{5}$

$y = \frac{3}{16}$

The solution is $\frac{3}{16}$.

Objective B Exercises, pages 211–212

25. The unknown number: n

$\boxed{\text{a number minus one-third}}$ equals $\boxed{\text{one-half}}$

$n - \frac{1}{3} = \frac{1}{2}$

$n - \frac{1}{3} + \frac{1}{3} = \frac{1}{2} + \frac{1}{3}$

$n = \frac{3}{6} + \frac{2}{6}$

$n = \frac{5}{6}$

The number is $\frac{5}{6}$.

26. The unknown number: n

$\boxed{\text{the sum of a number and one-fourth}}$ is $\boxed{\text{one-sixth}}$

$n + \frac{1}{4} = \frac{1}{6}$

$n + \frac{1}{4} - \frac{1}{4} = \frac{1}{6} - \frac{1}{4}$

$n = \frac{2}{12} - \frac{3}{12}$

$n = -\frac{1}{12}$

The number is $-\frac{1}{12}$.

27. The unknown number: n

three-fifths times a number	is	nine-tenths

$\frac{3}{5}n=\frac{9}{10}$

$\frac{5}{3}\cdot\frac{3}{5}n=\frac{5}{3}\cdot\frac{9}{10}$

$n=\frac{3}{2}$

$n=1\frac{1}{2}$

The number is $1\frac{1}{2}$.

28. The unknown number: n

the product of negative two-thirds and a number	is	five-sixths

$-\frac{2}{3}n=\frac{5}{6}$

$-\frac{3}{2}\left(-\frac{2}{3}n\right)=-\frac{3}{2}\left(\frac{5}{6}\right)$

$n=-\frac{5}{4}$

$n=-1\frac{1}{4}$

The number is $-1\frac{1}{4}$.

29. The unknown number: n

the quotient of a number and negative four	is	three-fourths

$\frac{n}{-4}=\frac{3}{4}$

$-4\left(\frac{n}{-4}\right)=-4\left(\frac{3}{4}\right)$

$n=-3$

The number is –3.

30. The unknown number: n

a number divided by negative two	equals	two-fifths

$\frac{n}{-2}=\frac{2}{5}$

$-2\left(\frac{n}{-2}\right)=-2\left(\frac{2}{5}\right)$

$n=-\frac{4}{5}$

The number is $-\frac{4}{5}$.

31. The unknown number: n

negative three-fourths of a number	is equal to	one-sixth

$-\frac{3}{4}n=\frac{1}{6}$

$-\frac{4}{3}\left(-\frac{3}{4}n\right)=-\frac{4}{3}\left(\frac{1}{6}\right)$

$n=-\frac{2}{9}$

The number is $-\frac{2}{9}$.

32. The unknown number: n

$\boxed{\text{negative three-eighths}}$ equals $\boxed{\text{the product of two-thirds and some number}}$

$-\frac{3}{8}=\frac{2}{3}n$

$\frac{3}{2}\left(-\frac{3}{8}\right)=\frac{3}{2}\left(\frac{2}{3}n\right)$

$-\frac{9}{16}=n$

The number is $-\frac{9}{16}$.

33. Strategy To find the total sales, write and solve an equation using x to represent the total sales.

Solution $\boxed{\text{one-twenty-fourths of the total sales}}$ is $\boxed{\text{direct marketing sales}}$

$\frac{1}{24}x=96$

$\frac{24}{1}\left(\frac{1}{24}x\right)=\frac{24}{1}(96)$

$x=2{,}304$

J.C. Penney's total sales for the 4-week period was \$2,304 million.

34. Strategy To find the total number of calories in one serving, write and solve an equation using x to represent the total number of calories in one serving.

Solution $\boxed{\text{the number of calories from fat}}$ is $\boxed{\text{one-half the total number of calories in one serving}}$

$112=\frac{1}{2}x$

$2(112)=2\left(\frac{1}{2}x\right)$

$224=x$

There are 224 calories in one serving of potato chips.

35. Strategy To find the total number of quarts in the punch, write and solve an equation using x to represent the total number of quarts in the punch.

Solution $\boxed{\text{the number of quarts of orange juice}}$ is $\boxed{\text{three-fifths of the total number of quarts}}$

$15=\frac{3}{5}x$

$\frac{5}{3}(15)=\frac{5}{3}\left(\frac{3}{5}x\right)$

$25=x$

There is a total of 25 quarts in the punch.

36. Strategy To find the number of eligible voters, write and solve an equation using x to represent the number of eligible voters.

Solution $\boxed{\text{the number who voted}}$ was $\boxed{\text{two-thirds of the number of eligible voters}}$

$24{,}416=\frac{2}{3}x$

$\frac{3}{2}(24{,}416)=\frac{3}{2}\left(\frac{2}{3}x\right)$

$36{,}624=x$

There were 36,624 eligible voters.

37. Strategy To find the mechanic's monthly income, write and solve an equation using x to represent the monthly income.

Solution $\boxed{\text{the rent}}$ is $\boxed{\text{two-fifths of the monthly income}}$

$600 = \frac{2}{5}x$

$\frac{5}{2}(600) = \frac{5}{2}\left(\frac{2}{5}x\right)$

$1{,}500 = x$

The mechanic's monthly income is \$1,500.

38. Strategy To find the number of miles, replace a by 26 and g by 16 in the given formula and solve for m.

Solution $a = \frac{m}{g}$

$26 = \frac{m}{16}$

$16 \cdot 26 = 16 \cdot \frac{m}{16}$

$416 = m$

The car can travel 416 mi on 16 gal of gas.

39. Strategy To find the number of miles, replace a by 14 and g by 38 in the given formula and solve for m.

Solution $a = \frac{m}{g}$

$14 = \frac{m}{38}$

$38 \cdot 14 = 38 \cdot \frac{m}{38}$

$532 = m$

The truck can travel 532 mi on 38 gal of diesel fuel.

Critical Thinking 3.5, page 212

40. $\frac{3}{8}x = -\frac{1}{4}$

$\frac{8}{3}\left(\frac{3}{8}x\right) = \frac{8}{3}\left(-\frac{1}{4}\right)$

$x = -\frac{2}{3}$

$6x = 6\left(-\frac{2}{3}\right) = -4$

$-4 < -1$

$6x < -1$

41. $-\frac{x}{2}=\frac{2}{3}$

$-2\left(-\frac{1}{2}x\right)=-2\left(\frac{2}{3}\right)$

$x=-\frac{4}{3}$

$-9\left(-\frac{4}{3}\right)=12$ and $12 > 10$, so $-9x > 10$, and **a** is true.

$-6\left(-\frac{4}{3}\right)=8$, but 8 is not less than 8, so $-6x$ is not less than 8, and **b** is not true. Since **b** is not true, **c** is not true. Only **a** is true.

Section 3.6

Objective A Exercises, page 219

1. $\left(\frac{3}{4}\right)^2=\frac{3}{4}\cdot\frac{3}{4}$
$=\frac{3\cdot3}{4\cdot4}=\frac{9}{16}$

2. $\left(\frac{5}{8}\right)^2=\frac{5}{8}\cdot\frac{5}{8}$
$=\frac{5\cdot5}{8\cdot8}=\frac{25}{64}$

3. $\left(-\frac{1}{6}\right)^3=\left(-\frac{1}{6}\right)\left(-\frac{1}{6}\right)\left(-\frac{1}{6}\right)$
$=-\left(\frac{1}{6}\cdot\frac{1}{6}\cdot\frac{1}{6}\right)$
$=-\frac{1\cdot1\cdot1}{6\cdot6\cdot6}=-\frac{1}{216}$

4. $\left(-\frac{2}{7}\right)^3=\left(-\frac{2}{7}\right)\left(-\frac{2}{7}\right)\left(-\frac{2}{7}\right)$
$=-\left(\frac{2}{7}\cdot\frac{2}{7}\cdot\frac{2}{7}\right)$
$=-\frac{2\cdot2\cdot2}{7\cdot7\cdot7}=-\frac{8}{343}$

5. $\left(2\frac{1}{4}\right)^2=\left(\frac{9}{4}\right)^2$
$=\frac{9}{4}\cdot\frac{9}{4}$
$=\frac{9\cdot9}{4\cdot4}=\frac{81}{16}=5\frac{1}{16}$

6. $\left(3\frac{1}{2}\right)^2=\left(\frac{7}{2}\right)^2$
$=\frac{7}{2}\cdot\frac{7}{2}$
$=\frac{49}{4}=12\frac{1}{4}$

7. $\left(\frac{5}{8}\right)^3\cdot\left(\frac{2}{5}\right)^2=\frac{5}{8}\cdot\frac{5}{8}\cdot\frac{5}{8}\cdot\frac{2}{5}\cdot\frac{2}{5}$
$=\frac{5\cdot5\cdot5\cdot2\cdot2}{8\cdot8\cdot8\cdot5\cdot5}$
$=\frac{5}{128}$

8. $\left(\frac{3}{5}\right)^3\cdot\left(\frac{1}{3}\right)^2=\frac{3}{5}\cdot\frac{3}{5}\cdot\frac{3}{5}\cdot\frac{1}{3}\cdot\frac{1}{3}$
$=\frac{3\cdot3\cdot3\cdot1\cdot1}{5\cdot5\cdot5\cdot3\cdot3}$
$=\frac{3}{125}$

9. $\left(\frac{18}{25}\right)^2\cdot\left(\frac{5}{9}\right)^3$
$=\frac{18}{25}\cdot\frac{18}{25}\cdot\frac{5}{9}\cdot\frac{5}{9}\cdot\frac{5}{9}$
$=\frac{18\cdot18\cdot5\cdot5\cdot5}{25\cdot25\cdot9\cdot9\cdot9}$
$=\frac{4}{45}$

10. $\left(\frac{2}{3}\right)^3\cdot\left(\frac{5}{6}\right)^2=\frac{2}{3}\cdot\frac{2}{3}\cdot\frac{2}{3}\cdot\frac{5}{6}\cdot\frac{5}{6}$
$=\frac{2\cdot2\cdot2\cdot5\cdot5}{3\cdot3\cdot3\cdot6\cdot6}$
$=\frac{50}{243}$

11. $\left(\frac{4}{5}\right)^4\cdot\left(-\frac{5}{8}\right)^3$
$=\frac{4}{5}\cdot\frac{4}{5}\cdot\frac{4}{5}\cdot\frac{4}{5}\cdot\left(-\frac{5}{8}\right)\left(-\frac{5}{8}\right)\left(-\frac{5}{8}\right)$
$=-\left(\frac{4}{5}\cdot\frac{4}{5}\cdot\frac{4}{5}\cdot\frac{4}{5}\cdot\frac{5}{8}\cdot\frac{5}{8}\cdot\frac{5}{8}\right)$
$=-\frac{4\cdot4\cdot4\cdot4\cdot5\cdot5\cdot5}{5\cdot5\cdot5\cdot5\cdot8\cdot8\cdot8}=-\frac{1}{10}$

12. $\left(-\frac{9}{11}\right)^2 \cdot \left(\frac{1}{3}\right)^4$
$= \left(-\frac{9}{11}\right)\left(-\frac{9}{11}\right)\frac{1}{3}\cdot\frac{1}{3}\cdot\frac{1}{3}\cdot\frac{1}{3}$
$= \frac{9}{11}\cdot\frac{9}{11}\cdot\frac{1}{3}\cdot\frac{1}{3}\cdot\frac{1}{3}\cdot\frac{1}{3}$
$= \frac{9\cdot 9\cdot 1\cdot 1\cdot 1\cdot 1}{11\cdot 11\cdot 3\cdot 3\cdot 3\cdot 3} = \frac{1}{121}$

13. $7^2 \cdot \left(\frac{2}{7}\right)^3 = \frac{7}{1}\cdot\frac{7}{1}\cdot\frac{2}{7}\cdot\frac{2}{7}\cdot\frac{2}{7}$
$= \frac{7\cdot 7\cdot 2\cdot 2\cdot 2}{1\cdot 1\cdot 7\cdot 7\cdot 7}$
$= \frac{8}{7} = 1\frac{1}{7}$

14. $4^3 \cdot \left(\frac{5}{12}\right)^2 = \frac{4}{1}\cdot\frac{4}{1}\cdot\frac{4}{1}\cdot\frac{5}{12}\cdot\frac{5}{12}$
$= \frac{4\cdot 4\cdot 4\cdot 5\cdot 5}{1\cdot 1\cdot 1\cdot 12\cdot 12}$
$= \frac{100}{9} = 11\frac{1}{9}$

15. $4 \cdot \left(\frac{4}{7}\right)^2 \cdot \left(-\frac{3}{4}\right)^3$
$= \frac{4}{1}\cdot\frac{4}{7}\cdot\frac{4}{7}\cdot\left(-\frac{3}{4}\right)\left(-\frac{3}{4}\right)\left(-\frac{3}{4}\right)$
$= -\left(\frac{4}{1}\cdot\frac{4}{7}\cdot\frac{4}{7}\cdot\frac{3}{4}\cdot\frac{3}{4}\cdot\frac{3}{4}\right)$
$= -\frac{4\cdot 4\cdot 4\cdot 3\cdot 3\cdot 3}{1\cdot 7\cdot 7\cdot 4\cdot 4\cdot 4}$
$= -\frac{27}{49}$

16. $3 \cdot \left(\frac{2}{5}\right)^2 \cdot \left(-\frac{1}{6}\right)^2$
$= \frac{3}{1}\cdot\frac{2}{5}\cdot\frac{2}{5}\cdot\left(-\frac{1}{6}\right)\left(-\frac{1}{6}\right)$
$= \frac{3}{1}\cdot\frac{2}{5}\cdot\frac{2}{5}\cdot\frac{1}{6}\cdot\frac{1}{6}$
$= \frac{3\cdot 2\cdot 2\cdot 1\cdot 1}{1\cdot 5\cdot 5\cdot 6\cdot 6} = \frac{1}{75}$

17. x^4
$\left(\frac{2}{3}\right)^4 = \frac{2}{3}\cdot\frac{2}{3}\cdot\frac{2}{3}\cdot\frac{2}{3}$
$= \frac{2\cdot 2\cdot 2\cdot 2}{3\cdot 3\cdot 3\cdot 3}$
$= \frac{16}{81}$

18. y^3
$\left(-\frac{3}{4}\right)^3 = \left(-\frac{3}{4}\right)\left(-\frac{3}{4}\right)\left(-\frac{3}{4}\right)$
$= -\left(\frac{3}{4}\cdot\frac{3}{4}\cdot\frac{3}{4}\right)$
$= -\frac{3\cdot 3\cdot 3}{4\cdot 4\cdot 4}$
$= -\frac{27}{64}$

19. x^4y^2
$\left(\frac{5}{6}\right)^4 \cdot \left(-\frac{3}{5}\right)^2 = \frac{5}{6}\cdot\frac{5}{6}\cdot\frac{5}{6}\cdot\frac{5}{6}\left(-\frac{3}{5}\right)\left(-\frac{3}{5}\right)$
$= \frac{5}{6}\cdot\frac{5}{6}\cdot\frac{5}{6}\cdot\frac{5}{6}\cdot\frac{3}{5}\cdot\frac{3}{5}$
$= \frac{5\cdot 5\cdot 5\cdot 5\cdot 3\cdot 3}{6\cdot 6\cdot 6\cdot 6\cdot 5\cdot 5}$
$= \frac{25}{144}$

20. x^5y^3
$\left(-\frac{5}{8}\right)^5 \cdot \left(\frac{4}{5}\right)^3$
$= \left(-\frac{5}{8}\right)\left(-\frac{5}{8}\right)\left(-\frac{5}{8}\right)\left(-\frac{5}{8}\right)\left(-\frac{5}{8}\right)\frac{4}{5}\cdot\frac{4}{5}\cdot\frac{4}{5}$
$= -\left(\frac{5}{8}\cdot\frac{5}{8}\cdot\frac{5}{8}\cdot\frac{5}{8}\cdot\frac{5}{8}\cdot\frac{4}{5}\cdot\frac{4}{5}\cdot\frac{4}{5}\right)$
$= -\frac{5\cdot 5\cdot 5\cdot 5\cdot 5\cdot 4\cdot 4\cdot 4}{8\cdot 8\cdot 8\cdot 8\cdot 8\cdot 5\cdot 5\cdot 5} = -\frac{25}{512}$

21. x^3y^2
$\left(\frac{2}{3}\right)^3 \cdot \left(1\frac{1}{2}\right)^2 = \frac{2}{3}\cdot\frac{2}{3}\cdot\frac{2}{3}\cdot\frac{3}{2}\cdot\frac{3}{2}$
$= \frac{2\cdot 2\cdot 2\cdot 3\cdot 3}{3\cdot 3\cdot 3\cdot 2\cdot 2}$
$= \frac{2}{3}$

22. x^2y^4
$\left(2\frac{1}{3}\right)^2 \cdot \left(\frac{3}{7}\right)^4 = \frac{7}{3}\cdot\frac{7}{3}\cdot\frac{3}{7}\cdot\frac{3}{7}\cdot\frac{3}{7}\cdot\frac{3}{7}$
$= \frac{7\cdot 7\cdot 3\cdot 3\cdot 3\cdot 3}{3\cdot 3\cdot 7\cdot 7\cdot 7\cdot 7}$
$= \frac{9}{49}$

Objective B Exercises, pages 219–220

23. $\frac{\frac{9}{16}}{\frac{3}{4}} = \frac{9}{16} \div \frac{3}{4}$
$= \frac{9}{16}\cdot\frac{4}{3} = \frac{3}{4}$

24. $\dfrac{\frac{7}{24}}{\frac{3}{8}} = \dfrac{7}{24} \div \dfrac{3}{8}$
$= \dfrac{7}{24} \cdot \dfrac{8}{3} = \dfrac{7}{9}$

25. $\dfrac{-\frac{5}{6}}{\frac{15}{16}} = -\dfrac{5}{6} \div \dfrac{15}{16}$
$= -\left(\dfrac{5}{6} \cdot \dfrac{16}{15}\right) = -\dfrac{8}{9}$

26. $\dfrac{\frac{7}{12}}{-\frac{5}{18}} = \dfrac{7}{12} \div \left(-\dfrac{5}{18}\right)$
$= -\left(\dfrac{7}{12} \div \dfrac{5}{18}\right)$
$= -\left(\dfrac{7}{12} \cdot \dfrac{18}{5}\right) = -\dfrac{21}{10} = -2\dfrac{1}{10}$

27. $\dfrac{\frac{2}{3} + \frac{1}{2}}{7} = \dfrac{\frac{7}{6}}{\frac{7}{1}}$
$= \dfrac{7}{6} \div \dfrac{7}{1}$
$= \dfrac{7}{6} \cdot \dfrac{1}{7} = \dfrac{1}{6}$

28. $\dfrac{-5}{\frac{3}{8} - \frac{1}{4}} = \dfrac{-5}{\frac{1}{8}}$
$= -\dfrac{5}{1} \div \dfrac{1}{8}$
$= -\dfrac{5}{1} \cdot \dfrac{8}{1} = -40$

29. $\dfrac{2 + \frac{1}{4}}{\frac{3}{8}} = \dfrac{\frac{9}{4}}{\frac{3}{8}}$
$= \dfrac{9}{4} \div \dfrac{3}{8}$
$= \dfrac{9}{4} \cdot \dfrac{8}{3} = 6$

30. $\dfrac{1 - \frac{3}{4}}{\frac{5}{12}} = \dfrac{\frac{1}{4}}{\frac{5}{12}}$
$= \dfrac{1}{4} \div \dfrac{5}{12}$
$= \dfrac{1}{4} \cdot \dfrac{12}{5} = \dfrac{3}{5}$

31. $\dfrac{\frac{9}{25}}{\frac{4}{5} - \frac{1}{10}} = \dfrac{\frac{9}{25}}{\frac{7}{10}}$
$= \dfrac{9}{25} \div \dfrac{7}{10}$
$= \dfrac{9}{25} \cdot \dfrac{10}{7} = \dfrac{18}{35}$

32. $\dfrac{-\frac{5}{7}}{\frac{4}{7} - \frac{3}{14}} = \dfrac{-\frac{5}{7}}{\frac{5}{14}}$
$= -\dfrac{5}{7} \div \dfrac{5}{14}$
$= -\dfrac{5}{7} \cdot \dfrac{14}{5} = -2$

33. $\dfrac{\frac{1}{3} - \frac{3}{4}}{\frac{1}{6} + \frac{2}{3}} = \dfrac{-\frac{5}{12}}{\frac{5}{6}}$
$= -\dfrac{5}{12} \div \dfrac{5}{6}$
$= -\left(\dfrac{5}{12} \cdot \dfrac{6}{5}\right) = -\dfrac{1}{2}$

34. $\dfrac{\frac{9}{14} - \frac{1}{7}}{\frac{9}{14} + \frac{1}{7}} = \dfrac{\frac{1}{2}}{\frac{11}{14}}$
$= \dfrac{1}{2} \div \dfrac{11}{14}$
$= \dfrac{1}{2} \cdot \dfrac{14}{11} = \dfrac{7}{11}$

35. $\dfrac{3 + 2\frac{1}{3}}{5\frac{1}{6} - 1} = \dfrac{5\frac{1}{3}}{4\frac{1}{6}}$
$= 5\dfrac{1}{3} \div 4\dfrac{1}{6}$
$= \dfrac{16}{3} \div \dfrac{25}{6}$
$= \dfrac{16}{3} \cdot \dfrac{6}{25} = \dfrac{32}{25} = 1\dfrac{7}{25}$

36. $\dfrac{4 - 3\frac{5}{8}}{2\frac{1}{2} - \frac{3}{4}} = \dfrac{\frac{3}{8}}{\frac{7}{4}}$
$= \dfrac{3}{8} \div \dfrac{7}{4}$
$= \dfrac{3}{8} \cdot \dfrac{4}{7} = \dfrac{3}{14}$

37. $\dfrac{5\frac{2}{3} - 1\frac{1}{6}}{3\frac{5}{8} - 2\frac{1}{4}} = \dfrac{4\frac{1}{2}}{1\frac{3}{8}}$
$= 4\dfrac{1}{2} \div 1\dfrac{3}{8}$
$= \dfrac{9}{2} \div \dfrac{11}{8}$
$= \dfrac{9}{2} \cdot \dfrac{8}{11} = \dfrac{36}{11} = 3\dfrac{3}{11}$

38. $\dfrac{3\frac{1}{4}-2\frac{1}{2}}{4\frac{3}{4}+1\frac{1}{2}}=\dfrac{\frac{3}{4}}{6\frac{1}{4}}$

$=\frac{3}{4}\div 6\frac{1}{4}=\frac{3}{4}\div\frac{25}{4}$

$=\frac{3}{4}\cdot\frac{4}{25}=\frac{3}{25}$

39. $\dfrac{x+y}{z}$

$\dfrac{\frac{2}{3}+\frac{3}{4}}{\frac{1}{12}}=\dfrac{\frac{17}{12}}{\frac{1}{12}}$

$=\frac{17}{12}\div\frac{1}{12}$

$=\frac{17}{12}\cdot\frac{12}{1}=17$

40. $\dfrac{x}{y+z}$

$\dfrac{\frac{8}{15}}{\frac{3}{5}+\frac{2}{3}}=\dfrac{\frac{8}{15}}{\frac{19}{15}}$

$=\frac{8}{15}\div\frac{19}{15}$

$=\frac{8}{15}\cdot\frac{15}{19}=\frac{8}{19}$

41. $\dfrac{xy}{z}$

$\dfrac{\frac{3}{4}\cdot\left(-\frac{2}{3}\right)}{\frac{5}{8}}=\dfrac{-\frac{1}{2}}{\frac{5}{8}}$

$=-\frac{1}{2}\div\frac{5}{8}$

$=-\frac{1}{2}\cdot\frac{8}{5}=-\frac{4}{5}$

42. $\dfrac{x}{yz}$

$\dfrac{-\frac{5}{12}}{\frac{8}{9}\cdot\left(-\frac{3}{4}\right)}=\dfrac{-\frac{5}{12}}{-\frac{2}{3}}$

$=-\frac{5}{12}\div\left(-\frac{2}{3}\right)$

$=\frac{5}{12}\cdot\frac{3}{2}=\frac{5}{8}$

43. $\dfrac{x-y}{z}$

$\dfrac{2\frac{5}{8}-1\frac{1}{4}}{1\frac{3}{8}}=\dfrac{1\frac{3}{8}}{1\frac{3}{8}}$

$=1\frac{3}{8}\div 1\frac{3}{8}=\frac{11}{8}\div\frac{11}{8}$

$=\frac{11}{8}\cdot\frac{8}{11}=1$

44. $\dfrac{x}{y-z}$

$\dfrac{2\frac{3}{10}}{3\frac{2}{5}-1\frac{4}{5}}=\dfrac{\frac{23}{10}}{1\frac{3}{5}}$

$=\frac{23}{10}\div 1\frac{3}{5}$

$=\frac{23}{10}\div\frac{8}{5}$

$=\frac{23}{10}\cdot\frac{5}{8}=\frac{23}{16}=1\frac{7}{16}$

45. $\dfrac{4x}{x+5}=-\dfrac{4}{3}$

$$\begin{array}{r|l}
\dfrac{4\left(-\frac{3}{4}\right)}{-\frac{3}{4}+5} & -\frac{4}{3} \\
\dfrac{-3}{\frac{17}{4}} & -\frac{4}{3} \\
-3\div\frac{17}{4} & -\frac{4}{3} \\
\frac{-3}{1}\cdot\frac{4}{17} & -\frac{4}{3}
\end{array}$$

$-\frac{12}{17}\neq-\frac{4}{3}$

No, $-\frac{3}{4}$ is not a solution of the equation.

46. $\dfrac{15y}{\frac{3}{10}+y}=-24$

$$\begin{array}{r|l}
\dfrac{15\left(-\frac{4}{5}\right)}{\frac{3}{10}+\left(-\frac{4}{5}\right)} & -24 \\
\dfrac{-12}{-\frac{1}{2}} & -24 \\
-12\div\left(-\frac{1}{2}\right) & -24 \\
12\cdot 2 & -24
\end{array}$$

$24\neq-24$

No, $-\frac{4}{5}$ is not a solution of the equation.

Objective C Exercises, pages 221–222

47. $\frac{3}{7}\cdot\frac{14}{15}+\frac{4}{5}=\frac{2}{5}+\frac{4}{5}$

$=\frac{6}{5}=1\frac{1}{5}$

48. $\frac{3}{5}\div\frac{6}{7}+\frac{4}{5}=\frac{3}{5}\cdot\frac{7}{6}+\frac{4}{5}$

$=\frac{7}{10}+\frac{4}{5}$

$=\frac{15}{10}=1\frac{1}{2}$

49. $$\left(\frac{5}{6}\right)^2-\frac{5}{9}=\frac{25}{36}-\frac{5}{9}$$
$$=\frac{5}{36}$$

50. $$\left(\frac{3}{5}\right)^2-\frac{3}{10}=\frac{9}{25}-\frac{3}{10}$$
$$=\frac{3}{50}$$

51. $$\frac{3}{4}\cdot\left(\frac{11}{12}-\frac{7}{8}\right)+\frac{5}{16}=\frac{3}{4}\cdot\frac{1}{24}+\frac{5}{16}$$
$$=\frac{1}{32}+\frac{5}{16}$$
$$=\frac{11}{32}$$

52. $$\frac{7}{18}+\frac{5}{6}\cdot\left(\frac{2}{3}-\frac{1}{6}\right)=\frac{7}{18}+\frac{5}{6}\cdot\frac{1}{2}$$
$$=\frac{7}{18}+\frac{5}{12}$$
$$=\frac{29}{36}$$

53. $$\frac{11}{16}-\left(\frac{3}{4}\right)^2+\frac{7}{8}=\frac{11}{16}-\frac{9}{16}+\frac{7}{8}$$
$$=\frac{1}{8}+\frac{7}{8}$$
$$=1$$

54. $$\left(-\frac{2}{3}\right)^2-\frac{7}{18}+\frac{5}{6}=\frac{4}{9}-\frac{7}{18}+\frac{5}{6}$$
$$=\frac{1}{18}+\frac{5}{6}$$
$$=\frac{8}{9}$$

55. $$\left(1\frac{1}{3}-\frac{5}{6}\right)+\frac{7}{8}\div\left(-\frac{1}{2}\right)^2$$
$$=\frac{1}{2}+\frac{7}{8}\div\left(-\frac{1}{2}\right)^2$$
$$=\frac{1}{2}+\frac{7}{8}\div\frac{1}{4}$$
$$=\frac{1}{2}+\frac{7}{8}\cdot\frac{4}{1}$$
$$=\frac{1}{2}+\frac{7}{2}=4$$

56. $$\left(\frac{1}{4}\right)^2\div\left(2\frac{1}{2}-\frac{3}{4}\right)+\frac{5}{7}=\left(\frac{1}{4}\right)^2\div\frac{7}{4}+\frac{5}{7}$$
$$=\frac{1}{16}\div\frac{7}{4}+\frac{5}{7}$$
$$=\frac{1}{16}\cdot\frac{4}{7}+\frac{5}{7}$$
$$=\frac{1}{28}+\frac{5}{7}=\frac{3}{4}$$

57. $$\left(\frac{2}{3}\right)^2+\frac{8-7}{3-9}\div\frac{3}{8}=\left(\frac{2}{3}\right)^2+\left(-\frac{1}{6}\right)\div\frac{3}{8}$$
$$=\frac{4}{9}+\left(-\frac{1}{6}\right)\div\frac{3}{8}$$
$$=\frac{4}{9}+\left(-\frac{1}{6}\right)\frac{8}{3}$$
$$=\frac{4}{9}+\left(\frac{-4}{9}\right)=0$$

58. $$\left(\frac{1}{3}\right)^2\cdot\frac{14-5}{6-10}+\frac{3}{4}$$
$$=\left(\frac{1}{3}\right)^2\cdot\left(-\frac{9}{4}\right)+\frac{3}{4}$$
$$=\frac{1}{9}\left(-\frac{9}{4}\right)+\frac{3}{4}$$
$$=-\frac{1}{4}+\frac{3}{4}=\frac{1}{2}$$

59. $$\frac{1}{2}+\frac{\frac{13}{25}}{4-\frac{3}{4}}\div\frac{1}{5}=\frac{1}{2}+\frac{\frac{13}{25}}{\frac{13}{4}}\div\frac{1}{5}$$
$$=\frac{1}{2}+\frac{13}{25}\div\frac{13}{4}\div\frac{1}{5}$$
$$=\frac{1}{2}+\frac{13}{25}\cdot\frac{4}{13}\div\frac{1}{5}$$
$$=\frac{1}{2}+\frac{4}{25}\div\frac{1}{5}=\frac{1}{2}+\frac{4}{25}\cdot\frac{5}{1}$$
$$=\frac{1}{2}+\frac{4}{5}=\frac{13}{10}=1\frac{3}{10}$$

60. $$\frac{4}{5}+\frac{3-\frac{7}{9}}{\frac{5}{6}}\cdot\frac{3}{8}=\frac{4}{5}+\frac{\frac{20}{9}}{\frac{5}{6}}\cdot\frac{3}{8}$$
$$=\frac{4}{5}+\frac{20}{9}\div\frac{5}{6}\cdot\frac{3}{8}$$
$$=\frac{4}{5}+\frac{20}{9}\cdot\frac{6}{5}\cdot\frac{3}{8}$$
$$=\frac{4}{5}+\frac{8}{3}\cdot\frac{3}{8}$$
$$=\frac{4}{5}+1=1\frac{4}{5}$$

61. $\left(\frac{2}{3}\right)^2+\frac{\frac{5}{8}-\frac{1}{4}}{\frac{2}{3}-\frac{1}{6}}\cdot\frac{8}{9}=\left(\frac{2}{3}\right)^2+\frac{\frac{3}{8}}{\frac{1}{2}}\cdot\frac{8}{9}$

$=\left(\frac{2}{3}\right)^2+\frac{3}{8}\div\frac{1}{2}\cdot\frac{8}{9}$

$=\frac{4}{9}+\frac{3}{8}\div\frac{1}{2}\cdot\frac{8}{9}$

$=\frac{4}{9}+\frac{3}{8}\cdot\frac{2}{1}\cdot\frac{8}{9}$

$=\frac{4}{9}+\frac{3}{4}\cdot\frac{8}{9}$

$=\frac{4}{9}+\frac{2}{3}=\frac{10}{9}=1\frac{1}{9}$

62. $x^2+\frac{y}{z}$

$\left(-\frac{2}{3}\right)^2+\frac{\frac{5}{8}}{\frac{3}{4}}=\left(-\frac{2}{3}\right)^2+\frac{5}{8}\div\frac{3}{4}$

$=\frac{4}{9}+\frac{5}{8}\div\frac{3}{4}$

$=\frac{4}{9}+\frac{5}{8}\cdot\frac{4}{3}$

$=\frac{4}{9}+\frac{5}{6}$

$=\frac{23}{18}=1\frac{5}{18}$

63. $\frac{x}{y}-z^2$

$\frac{\frac{5}{6}}{\frac{1}{3}}-\left(-\frac{3}{4}\right)^2=\frac{5}{6}\div\frac{1}{3}-\left(-\frac{3}{4}\right)^2$

$=\frac{5}{6}\div\frac{1}{3}-\frac{9}{16}$

$=\frac{5}{6}\cdot\frac{3}{1}-\frac{9}{16}$

$=\frac{5}{2}-\frac{9}{16}$

$=\frac{31}{16}=1\frac{15}{16}$

64. $x-y^3z$

$\frac{5}{6}-\left(\frac{1}{2}\right)^3\cdot\frac{8}{9}=\frac{5}{6}-\frac{1}{8}\cdot\frac{8}{9}$

$=\frac{5}{6}-\frac{1}{9}$

$=\frac{13}{18}$

65. xy^3+z

$\frac{9}{10}\cdot\left(\frac{1}{3}\right)^3+\frac{7}{15}=\frac{9}{10}\cdot\frac{1}{27}+\frac{7}{15}$

$=\frac{1}{30}+\frac{7}{15}$

$=\frac{1}{2}$

66. $\frac{wx}{y}+z$

$\frac{\frac{4}{5}\cdot\frac{5}{8}}{\frac{3}{4}}+\frac{2}{3}=\frac{\frac{1}{2}}{\frac{3}{4}}+\frac{2}{3}$

$=\frac{1}{2}\div\frac{3}{4}+\frac{2}{3}$

$=\frac{1}{2}\cdot\frac{4}{3}+\frac{2}{3}$

$=\frac{2}{3}+\frac{2}{3}=\frac{4}{3}=1\frac{1}{3}$

67. $\frac{w}{xy}-z$

$\frac{2\frac{1}{2}}{4\cdot\frac{3}{8}}-\frac{2}{3}=\frac{\frac{5}{2}}{\frac{3}{2}}-\frac{2}{3}$

$=\frac{5}{2}\div\frac{3}{2}-\frac{2}{3}$

$=\frac{5}{2}\cdot\frac{2}{3}-\frac{2}{3}$

$\frac{5}{3}-\frac{2}{3}=\frac{3}{3}=1$

68.

$$\begin{array}{r|l}
\multicolumn{2}{c}{\dfrac{-8z}{z+\frac{5}{6}}-4z=-14} \\
\hline
\dfrac{-8\left(-\frac{1}{2}\right)}{-\frac{1}{2}+\frac{5}{6}}-4\left(-\frac{1}{2}\right) & -14 \\
\dfrac{4}{\frac{1}{3}}+2 & -14 \\
\left(4\div\frac{1}{3}\right)+2 & -14 \\
(4\cdot 3)+2 & -14 \\
12+2 & -14 \\
\multicolumn{2}{c}{14\neq-14}
\end{array}$$

No, $-\frac{1}{2}$ is not a solution of the equation.

69. $\dfrac{12w}{\frac{1}{6}-w}=-7$

$$\begin{array}{c|c} \dfrac{12\left(-\frac{1}{3}\right)}{\frac{1}{6}-\left(-\frac{1}{3}\right)} & -7 \\ \dfrac{-4}{\frac{1}{2}} & -7 \\ -4\div\frac{1}{2} & -7 \\ -4\cdot 2 & -7 \end{array}$$

$$-8\neq -7$$

No, $-\frac{1}{3}$ is not a solution of the equation.

Critical Thinking 3.6, page 222

70. $\dfrac{\frac{3}{x}+\frac{2}{x}}{\frac{5}{6}}=\dfrac{\frac{5}{x}}{\frac{5}{6}}=\frac{5}{x}\div\frac{5}{6}=\frac{5}{x}\cdot\frac{6}{5}=\frac{6}{x}$

71. Time for one operation: $\frac{1}{600,000}$ (in seconds)

Time for 10^8 operations: $10^8\cdot\frac{1}{600,000}$ (in seconds)

or $10^8\cdot\frac{1}{600,000}\cdot\frac{1}{60}$ (in minutes)

$10^8\cdot\frac{1}{600,000}\cdot\frac{1}{60}=\frac{100}{36}=2\frac{7}{9}$

To the nearest minute, 10^8 operations will take place in 3 minutes.

72. The expression will be a minimum when x has its smallest value. The smallest whole number is 0.

$\left(\frac{3}{4}\right)^2+x^5\div\frac{7}{8}=\frac{9}{16}+0^5\div\frac{7}{8}=\frac{9}{16}+0\cdot\frac{8}{7}=\frac{9}{16}$.

The minimum value is $\frac{9}{16}$.

73. $\dfrac{u+\frac{v}{w}}{\frac{x}{y}}=\dfrac{\frac{uw+v}{w}}{\frac{x}{y}}=\frac{uw+v}{w}\div\frac{x}{y}=\frac{uw+v}{w}\cdot\frac{y}{x}=\frac{y(uw+v)}{wx}$

a. Note from the expression $\frac{y(uw+v)}{wx}$, that if x is doubled, then the expression is halved.

b. Note from the expression $\frac{y(uw+v)}{wx}$, that if y is doubled, then the expression is doubled.

Chapter Review Exercises, pages 227–228

1. $$\begin{array}{r} 9 \\ 2\overline{)\,19} \\ \underline{-18} \\ 1 \end{array}$$ $\frac{19}{2}=9\frac{1}{2}$

2. $6\frac{2}{9}-3\frac{7}{18}=6\frac{4}{18}-3\frac{7}{18}$
$=5\frac{22}{18}-3\frac{7}{18}$
$=2\frac{15}{18}=2\frac{5}{6}$

3. $x \div y$
$2\frac{5}{8}\div 1\frac{3}{4}=\frac{21}{8}\div\frac{7}{4}$
$=\frac{21}{8}\cdot\frac{4}{7}$
$=\frac{3}{2}=1\frac{1}{2}$

4. $\left(-2\frac{1}{3}\right)\frac{3}{7}=-\left(\frac{7}{3}\cdot\frac{3}{7}\right)$
$=-\frac{7\cdot 3}{3\cdot 7}$
$=-1$

5. $3\frac{3}{4}\div 1\frac{7}{8}=\frac{15}{4}\div\frac{15}{8}$
$=\frac{15}{4}\cdot\frac{8}{15}$
$=\frac{15\cdot 8}{4\cdot 15}$
$=\frac{3\cdot 5\cdot 2\cdot 2\cdot 2}{2\cdot 2\cdot 3\cdot 5}=2$

6. $3\cdot\frac{8}{9}=\frac{3}{1}\cdot\frac{8}{9}$
$=\frac{3\cdot 8}{1\cdot 9}$
$=\frac{3\cdot 2\cdot 2\cdot 2}{1\cdot 3\cdot 3}$
$=\frac{8}{3}=2\frac{2}{3}$

7. $\frac{x}{y+z}$
$\frac{\frac{7}{8}}{\frac{4}{5}+\left(-\frac{1}{2}\right)}=\frac{\frac{7}{8}}{\frac{3}{10}}$
$=\frac{7}{8}\div\frac{3}{10}$
$=\frac{7}{8}\cdot\frac{10}{3}=\frac{35}{12}=2\frac{11}{12}$

8. $\frac{3}{5}=\frac{9}{15}$ $\frac{7}{15}=\frac{7}{15}$
$\frac{9}{15}>\frac{7}{15}$
$\frac{3}{5}>\frac{7}{15}$

9. $50=2\cdot 5^2$
$75=3\cdot 5^2$
$\text{LCM}=2\cdot 3\cdot 5^2=150$

10. $6\frac{11}{15}+4\frac{7}{10}=6\frac{22}{30}+4\frac{21}{30}$
$=10\frac{43}{30}$
$=11\frac{13}{30}$

11. xy
$8\cdot\frac{5}{12}=\frac{8}{1}\cdot\frac{5}{12}$
$=\frac{8\cdot 5}{1\cdot 12}$
$=\frac{2\cdot 2\cdot 2\cdot 5}{1\cdot 2\cdot 2\cdot 3}$
$=\frac{10}{3}=3\frac{1}{3}$

12. $\frac{10}{7}, 1\frac{3}{7}$

13. $\frac{7}{8}=\frac{35}{40}$ $\frac{17}{20}=\frac{34}{40}$
$\frac{35}{49}>\frac{34}{40}$
$\frac{7}{8}>\frac{17}{20}$

14. $\frac{\frac{5}{8}-\frac{1}{4}}{\frac{1}{2}+\frac{1}{8}}=\frac{\frac{3}{8}}{\frac{5}{8}}$
$=\frac{3}{8}\div\frac{5}{8}$
$=\frac{3}{8}\cdot\frac{8}{5}$
$=\frac{3\cdot 8}{8\cdot 5}=\frac{3}{5}$

15. $72\div 9=8$
$\frac{4}{9}=\frac{4\cdot 8}{9\cdot 8}=\frac{32}{72}$
$\frac{32}{72}$ is equivalent to $\frac{4}{9}$.

16. x^2y^3
$\left(\frac{8}{9}\right)^2\cdot\left(-\frac{3}{4}\right)^3$
$=\frac{8}{9}\cdot\frac{8}{9}\cdot\left(-\frac{3}{4}\right)\left(-\frac{3}{4}\right)\left(-\frac{3}{4}\right)$
$=-\left(\frac{8}{9}\cdot\frac{8}{9}\cdot\frac{3}{4}\cdot\frac{3}{4}\cdot\frac{3}{4}\right)$
$=-\frac{8\cdot 8\cdot 3\cdot 3\cdot 3}{9\cdot 9\cdot 4\cdot 4\cdot 4}=-\frac{1}{3}$

17. $ab^2 - c$

$4\cdot\left(\frac{1}{2}\right)^2 - \frac{5}{7} = 4\cdot\frac{1}{4} - \frac{5}{7}$

$= \frac{4}{1}\cdot\frac{1}{4} - \frac{5}{7} = 1 - \frac{5}{7}$

$= \frac{7}{7} - \frac{5}{7}$

$= \frac{2}{7}$

18. $42 = 2\cdot 3\cdot 7$

$63 = 3\cdot 3\cdot 7$

$\text{GCF} = 3\cdot 7 = 21$

19. $2\frac{5}{14} = \frac{(14\cdot 2)+5}{14}$

$= \frac{28+5}{14} = \frac{33}{14}$

20. $x + y + z$

$\frac{5}{8} + \left(-\frac{3}{4}\right) + \frac{1}{2} = \frac{5}{8} + \frac{-3}{4} + \frac{1}{2}$

$= \frac{5}{8} + \frac{-6}{8} + \frac{4}{8}$

$= \frac{5+(-6)+4}{8}$

$= \frac{3}{8}$

21. $\frac{5}{9} \div \left(-\frac{2}{3}\right) = -\left(\frac{5}{9} \div \frac{2}{3}\right)$

$= -\left(\frac{5}{9}\cdot\frac{3}{2}\right)$

$= -\frac{5\cdot 3}{9\cdot 2}$

$= -\frac{5\cdot 3}{3\cdot 3\cdot 2} = -\frac{5}{6}$

22. $\frac{2}{5} \div \frac{4}{7} + \frac{3}{8} = \frac{2}{5}\cdot\frac{7}{4} + \frac{3}{8}$

$= \frac{7}{10} + \frac{3}{8}$

$= \frac{28}{40} + \frac{15}{40}$

$= \frac{28+15}{40} = \frac{43}{40} = 1\frac{3}{40}$

23. $5\frac{1}{4}\cdot\frac{8}{9}\cdot(-3) = -\left(\frac{21}{4}\cdot\frac{8}{9}\cdot\frac{3}{1}\right)$

$= -\frac{21\cdot 8\cdot 3}{4\cdot 9\cdot 1}$

$= -\frac{3\cdot 7\cdot 2\cdot 2\cdot 2\cdot 3}{2\cdot 2\cdot 3\cdot 3\cdot 1}$

$= -14$

24. $\frac{2}{3} - \frac{11}{18} = \frac{12}{18} - \frac{11}{18}$

$= \frac{12-11}{18}$

$= \frac{1}{18}$

25. $\frac{7}{8} - \left(-\frac{5}{6}\right) = \frac{7}{8} - \left(\frac{-5}{6}\right)$

$= \frac{21}{24} - \frac{-20}{24}$

$= \frac{21-(-20)}{24} = \frac{21+20}{24}$

$= \frac{41}{24} = 1\frac{17}{24}$

26. $\left(-\frac{3}{8}\right)^2\cdot 4^2 = \frac{9}{64}\cdot 16$

$= \frac{9}{64}\cdot\frac{16}{1}$

$= \frac{9}{4} = 2\frac{1}{4}$

27. $3\frac{7}{12} + 5\frac{1}{2} = 3\frac{7}{12} + 5\frac{6}{12}$

$= 8\frac{13}{12} = 9\frac{1}{12}$

28. $\frac{30}{105} = \frac{2\cdot 3\cdot 5}{3\cdot 5\cdot 7} = \frac{2}{7}$

29. $a - b$

$7 - 2\frac{3}{10} = 6\frac{10}{10} - 2\frac{3}{10}$

$= 4\frac{7}{10}$

30. $-\frac{5}{9} = \frac{1}{6} + p$

$-\frac{5}{9} - \frac{1}{6} = \frac{1}{6} - \frac{1}{6} + p$

$-\frac{10}{18} - \frac{3}{18} = p$

$-\frac{13}{18} = p$

The solution is $-\frac{13}{18}$.

31. Strategy To find the fraction, write a fraction with 40 in the numerator and the number of minutes in one hour (60) in the denominator. Write the fraction in simplest form.

Solution $\frac{40}{60} = \frac{2\cdot 2\cdot 2\cdot 5}{2\cdot 2\cdot 3\cdot 5} = \frac{2}{3}$

40 min is $\frac{2}{3}$ of an hour.

32. Strategy To find the entire length, substitute $12\frac{1}{12}$, $29\frac{1}{3}$, and $26\frac{3}{4}$ for a, b, and c in the given formula and solve for P.

Solution $P = a + b + c$

$$P = 12\frac{1}{12} + 29\frac{1}{3} + 26\frac{3}{4}$$
$$= 12\frac{1}{12} + 29\frac{4}{12} + 26\frac{9}{12}$$
$$= 68\frac{2}{12} = 68\frac{1}{6}$$

The entire length is $68\frac{1}{6}$ yd.

33. Strategy To find the amount of weight to gain:
→Add the amounts already gained $\left(3\frac{1}{2} + 2\frac{1}{4}\right)$
→Subtract the amount gained from the goal amount (12).

Solution
$$3\frac{1}{2} + 2\frac{1}{4} = 3\frac{2}{4} + 2\frac{1}{4}$$
$$= 5\frac{3}{4}$$
$$12 - 5\frac{3}{4} = 11\frac{4}{4} - 5\frac{3}{4} = 6\frac{1}{4}$$

The wrestler has $6\frac{1}{4}$ lb left to gain.

34. Strategy To find the number of units:
→Find the number of minutes in 8 h.
→Divide the number of minutes worked by the time to assemble one unit.

Solution $8 \cdot 60 = 480$
$$480 \div 2\frac{1}{2} = 480 \div \frac{5}{2}$$
$$= \frac{480}{1} \cdot \frac{2}{5}$$
$$= 192$$

35. Strategy To find the overtime pay, substitute $6\frac{1}{4}$ for H and 24 for R in the given formula and solve for P.

Solution $P = RH$
$$P = 24 \cdot 6\frac{1}{4}$$
$$P = 24 \cdot \frac{25}{4}$$
$$P = \frac{24}{1} \cdot \frac{25}{4} = 150$$

The employee is due \$150 in overtime pay.

36. Strategy To find the final veolcity, substitute 0 for S and $15\frac{1}{2}$ for t in the given formula and solve for t.

Solution $V = S + 32t$
$$V = 0 + 32 \cdot 15\frac{1}{2}$$
$$V = 32 \cdot \frac{31}{2}$$
$$V = \frac{32}{1} \cdot \frac{31}{2} = 496$$

The final velocity is 496 ft/s.

Chapter Test, pages 229–230

1.
$$7\overline{)\,18\,}\ \text{quotient } 2;\quad \begin{array}{r} 18 \\ -14 \\ \hline 4 \end{array}\qquad \frac{18}{7} = 2\frac{4}{7}$$

2.
$$7\frac{3}{4} - 3\frac{5}{6} = 7\frac{9}{12} - 3\frac{10}{12}$$
$$= 6\frac{21}{12} - 3\frac{10}{12}$$
$$= 3\frac{11}{12}$$

3. xy
$$6\frac{3}{7} \cdot 3\frac{1}{2} = \frac{45}{7} \cdot \frac{7}{2}$$
$$= \frac{45}{2}$$
$$= 22\frac{1}{2}$$

4. $-\frac{2}{3}\cdot\left(\frac{-7}{8}\right)=\frac{2}{3}\cdot\frac{7}{8}$

$=\frac{2\cdot 7}{3\cdot 8}$

$=\frac{7}{12}$

5. $30 = 2\cdot 3\cdot 5$
$45 = 3\cdot 3\cdot 5$
$\text{LCM} = 2\cdot 3^2\cdot 5 = 90$

6. $\frac{11}{12}+\left(\frac{-3}{8}\right)=\frac{22}{24}+\frac{-9}{24}$

$=\frac{22-9}{24}$

$=\frac{13}{24}$

7. x^3y^2

$\left(1\frac{1}{2}\right)^3\cdot\left(\frac{5}{6}\right)^2=\left(\frac{3}{2}\right)^3\cdot\left(\frac{5}{6}\right)^2$

$=\frac{3}{2}\cdot\frac{3}{2}\cdot\frac{3}{2}\cdot\frac{5}{6}\cdot\frac{5}{6}$

$=\frac{3\cdot 3\cdot 3\cdot 5\cdot 5}{2\cdot 2\cdot 2\cdot 6\cdot 6}$

$=\frac{75}{32}=2\frac{11}{32}$

8. $3\frac{4}{5}=\frac{(5\cdot 3)+4}{5}$

$=\frac{15+4}{5}=\frac{19}{5}$

9. $-\frac{7}{12}\div\left(\frac{-3}{4}\right)=\frac{7}{12}\cdot\frac{4}{3}$

$=\frac{7\cdot 4}{12\cdot 3}=\frac{7}{9}$

10. $\frac{2}{7}\div\frac{3}{14}+\frac{2}{3}=\frac{2}{7}\cdot\frac{14}{3}+\frac{2}{3}$

$=\frac{4}{3}+\frac{2}{3}=2$

11. $\frac{x}{yz}$

$\frac{\frac{7}{20}}{\frac{2}{15}\cdot\frac{3}{8}}=\frac{\frac{7}{20}}{\frac{1}{20}}$

$=\frac{7}{20}\div\frac{1}{20}$

$=\frac{7}{20}\cdot\frac{20}{1}=7$

12. $18 = 2\cdot 3^2$
$54 = 2\cdot 3^3$
$\text{GCF} = 2\cdot 3^2 = 18$

13. $\frac{13}{14}-\frac{16}{21}=\frac{39}{42}-\frac{32}{42}$

$=\frac{7}{42}=\frac{1}{6}$

14. $\frac{60}{75}=\frac{2\cdot 2\cdot 3\cdot 5}{3\cdot 5\cdot 5}=\frac{4}{5}$

15. $x+y+z$

$1\frac{3}{8}+\frac{1}{2}+\frac{5}{6}=1\frac{9}{24}+\frac{12}{24}+\frac{20}{24}$

$=2\frac{17}{24}$

16. $\frac{5}{6}=\frac{25}{30}$ $\quad\frac{11}{15}=\frac{22}{30}$

$\frac{25}{30}>\frac{22}{30}$

$\frac{5}{6}>\frac{11}{15}$

17. a^2b-c^2

$\left(\frac{2}{3}\right)^2\cdot 9-\left(\frac{3}{5}\right)^2=\frac{2}{3}\cdot\frac{2}{3}\cdot 9-\frac{3}{5}\cdot\frac{3}{5}$

$=4-\frac{9}{25}$

$=\frac{100}{25}-\frac{9}{25}$

$=\frac{91}{25}=3\frac{16}{25}$

18. $\dfrac{\frac{3}{4}-\frac{1}{3}}{\frac{1}{6}+\frac{1}{3}}=\dfrac{\frac{9}{12}-\frac{4}{12}}{\frac{1}{6}+\frac{2}{6}}=\dfrac{\frac{5}{12}}{\frac{3}{6}}$

$=\dfrac{5}{12}\div\dfrac{3}{6}$

$=\dfrac{5}{12}\cdot\dfrac{6}{3}=\dfrac{5}{6}$

19. $\dfrac{x-y}{z^3}$

$\dfrac{\frac{4}{9}-\frac{10}{27}}{\left(\frac{1}{3}\right)^3}=\dfrac{\frac{12}{27}-\frac{10}{27}}{\frac{2}{3}\cdot\frac{2}{3}\cdot\frac{2}{3}}=\dfrac{\frac{2}{27}}{\frac{8}{27}}$

$=\dfrac{2}{27}\div\dfrac{8}{27}$

$=\dfrac{2}{27}\cdot\dfrac{27}{8}=\dfrac{1}{4}$

20. $x-y$

$-\dfrac{8}{9}\div\dfrac{16}{27}=\dfrac{-8}{9}\cdot\dfrac{27}{16}$

$=-\dfrac{3}{2}=-1\dfrac{1}{2}$

21. $\dfrac{3x}{5}=-\dfrac{3}{10}$

$\dfrac{5}{3}\cdot\dfrac{3}{5}x=\dfrac{5}{3}\cdot\left(-\dfrac{3}{10}\right)$

$x=-\dfrac{1}{2}$

22. $z+\dfrac{1}{5}=\dfrac{11}{20}$

$$\begin{array}{r|l} -\frac{3}{4}+\frac{1}{5} & \frac{11}{20} \\ -\frac{15}{20}+\frac{4}{20} & \frac{11}{20} \\ -\frac{11}{20} & \frac{11}{20} \end{array}$$

$-\dfrac{11}{20}\neq\dfrac{11}{20}$

No, $-\frac{3}{4}$ is not a solution of the equation.

23. $2\dfrac{7}{8}\cdot\dfrac{2}{11}\cdot4=\dfrac{23}{8}\cdot\dfrac{2}{11}\cdot\dfrac{4}{1}$

$=\dfrac{23}{11}=2\dfrac{1}{11}$

24. $x+\dfrac{1}{3}=\dfrac{5}{6}$

$x+\dfrac{1}{3}-\dfrac{1}{3}=\dfrac{5}{6}-\dfrac{1}{3}$

$x=\dfrac{5}{6}-\dfrac{2}{6}$

$x=\dfrac{3}{6}=\dfrac{1}{2}$

25. $28\div7=4$

$\dfrac{3}{7}=\dfrac{3\cdot4}{7\cdot4}=\dfrac{12}{28}$

$\dfrac{12}{28}$ is equivalent to $\dfrac{3}{7}$.

26. The unknown number: n

a number minus one-half	equals	one-third

$n-\dfrac{1}{2}=\dfrac{1}{3}$

$n-\dfrac{1}{2}+\dfrac{1}{2}=\dfrac{1}{3}+\dfrac{1}{2}$

$n=\dfrac{2}{6}+\dfrac{3}{6}$

$n=\dfrac{5}{6}$

The number is $\frac{5}{6}$.

27. $\dfrac{10}{24}=\dfrac{5}{12}$

28. Strategy To find the amount of weight to lose:
→Add the amounts already lost $\left(11\frac{1}{6}+8\frac{5}{8}\right)$.
→Subtract the amount lost from the goal amount (30).

Solution $11\frac{1}{6}+8\frac{5}{8}=11\frac{4}{24}+8\frac{15}{24}$
$=19\frac{19}{24}$
$30-19\frac{19}{24}=29\frac{24}{24}-19\frac{19}{24}$
$=10\frac{5}{24}$

The patient has $10\frac{5}{24}$ lbs left to lose.

29. Strategy To find the amount of hamburger meat, multiply the number of hamburgers per person (2) by the weight of each hamburger $\left(\frac{1}{4}\right)$ by the number of guests (35).

Solution $2\cdot\frac{1}{4}\cdot 35=\frac{2}{1}\cdot\frac{1}{4}\cdot\frac{35}{1}=17\frac{1}{2}$

You should buy $17\frac{1}{2}$ lbs of hamburger.

30. Strategy To find the amount of felt needed, substitute 20 for b and 12 for h in the given formula and solve for A.

Solution $A=\frac{1}{2}bh$

$A=\frac{1}{2}\cdot 20\cdot 12=120$
The amount of felt needed is 120 in^2.

31. Strategy To find the amount of hours still required:
→Add the hours already contributed $\left(7\frac{1}{4}+2\frac{3}{4}\right)$.
→Subtract the amount already contributed from the total hours required (20).

Solution $7\frac{1}{4}+2\frac{3}{4}=10$
$20-10=10$
You must still contribute 10 h of community service.

32. Strategy To find the number of units:
→Multiply the number of hours (6) by 60 minutes.
→Divide the minutes by the time to assemble one unit $\left(4\frac{1}{2}\right)$.

Solution $6\cdot 60=360$
$360\div 4\frac{1}{2}=\frac{360}{1}\div\frac{9}{2}$
$=\frac{360}{1}\cdot\frac{2}{9}=80$
The employee can assemble 80 units in 6 h.

33. Strategy To find the cost, substitute price per share $\left(12\frac{3}{4}\right)$ for S and number of shares (400) for N in the given formula and solve for C.

Solution $C=SN$
$C=12\frac{3}{4}\cdot 400=\frac{51}{4}\cdot\frac{400}{1}$
$=5{,}100$
The cost is \$5,100.

Cumulative Review Exercises, pages 231–232

1. $3a+(a-b)^3$

$3\cdot 4+(4-1)^3=3\cdot 4+3^3$
$=3\cdot 4+27$
$=12+27$
$=39$

2. $4\cdot\frac{7}{8}=\frac{4}{1}\cdot\frac{7}{8}$
$=\frac{4\cdot 7}{1\cdot 8}$
$=\frac{2\cdot 2\cdot 7}{1\cdot 2\cdot 2\cdot 2}$
$=\frac{7}{2}=3\frac{1}{2}$

3. $4\frac{7}{9}+3\frac{5}{6}=4\frac{14}{18}+3\frac{15}{18}$
$=7\frac{29}{18}$
$=8\frac{11}{18}$

4. $-42-(-27)=-42+27$
$=-15$

5. $72=2\cdot 2\cdot 2\cdot 3\cdot 3$
$108=2\cdot 2\cdot 3\cdot 3\cdot 3$
$\text{GCF}=2\cdot 2\cdot 3\cdot 3=36$

6. $3\frac{1}{13}\cdot 5\frac{1}{5}=\frac{40}{13}\cdot\frac{26}{5}=\frac{40\cdot 26}{13\cdot 5}$
$=\frac{2\cdot 2\cdot 2\cdot 5\cdot 2\cdot 13}{13\cdot 5}$
$=16$

7. $\frac{8}{9}\div\left(-\frac{4}{5}\right)=-\left(\frac{8}{9}\div\frac{4}{5}\right)$
$=-\left(\frac{8}{9}\cdot\frac{5}{4}\right)$
$=-\frac{8\cdot 5}{9\cdot 4}$
$=-\frac{2\cdot 2\cdot 2\cdot 5}{3\cdot 3\cdot 2\cdot 2}$
$=-\frac{10}{9}=-1\frac{1}{9}$

8. $-\frac{2}{3}-\left(-\frac{2}{5}\right)=\frac{-2}{3}-\left(\frac{-2}{5}\right)$
$=\frac{-10}{15}-\frac{-6}{15}=\frac{-10-(-6)}{15}$
$=\frac{-10+6}{15}=\frac{-4}{15}=-\frac{4}{15}$

9. $\dfrac{\frac{1}{5}+\frac{1}{4}}{\frac{1}{4}-\frac{1}{5}}=\dfrac{\frac{9}{20}}{\frac{1}{20}}$
$=\frac{9}{20}\div\frac{1}{20}$
$=\frac{9}{20}\cdot\frac{20}{1}=\frac{9\cdot 20}{20\cdot 1}$
$=9$

10. $\frac{7}{11}=\frac{35}{55}\qquad\frac{4}{5}=\frac{44}{55}$
$\frac{35}{55}<\frac{44}{55}$
$\frac{7}{11}<\frac{4}{5}$

11. $-2\frac{1}{3}\div 1\frac{2}{7}=-\left(\frac{7}{3}\div\frac{9}{7}\right)$
$=-\left(\frac{7}{3}\cdot\frac{7}{9}\right)$
$=-\frac{7\cdot 7}{3\cdot 9}$
$=-\frac{7\cdot 7}{3\cdot 3\cdot 3}=-\frac{49}{27}$
$=-1\frac{22}{27}$

12. $-\frac{3}{8}\cdot\frac{2}{5}\cdot\left(-\frac{4}{9}\right)=\frac{3}{8}\cdot\frac{2}{5}\cdot\frac{4}{9}$
$=\frac{3\cdot 2\cdot 4}{8\cdot 5\cdot 9}$
$=\frac{3\cdot 2\cdot 2\cdot 2}{2\cdot 2\cdot 2\cdot 5\cdot 3\cdot 3}$
$=\frac{1}{15}$

13. abc
$\frac{4}{7}\cdot 1\frac{1}{6}\cdot 3=\frac{4}{7}\cdot\frac{7}{6}\cdot\frac{3}{1}$
$=\frac{4\cdot 7\cdot 3}{7\cdot 6\cdot 1}$
$=\frac{2\cdot 2\cdot 7\cdot 3}{7\cdot 2\cdot 3\cdot 1}=2$

14. $8\frac{3}{4}-1\frac{5}{7}=8\frac{21}{28}-1\frac{20}{28}$
$=7\frac{1}{28}$

15. $\frac{7}{12}-\left(-\frac{3}{8}\right)=\frac{7}{12}-\frac{-3}{8}$
$=\frac{14}{24}-\frac{-9}{24}=\frac{14-(-9)}{24}$
$=\frac{14+9}{24}=\frac{23}{24}$

16. $\frac{2}{5} \div \frac{9-6}{3+7} + \left(-\frac{1}{2}\right)^2 = \frac{2}{5} \div \frac{3}{10} + \left(-\frac{1}{2}\right)^2$
$= \frac{2}{5} \div \frac{3}{10} + \frac{1}{4}$
$= \frac{2}{5} \cdot \frac{10}{3} + \frac{1}{4}$
$= \frac{4}{3} + \frac{1}{4} = \frac{19}{12}$
$= 1\frac{7}{12}$

17. $a - b$
$\frac{3}{4} - \left(-\frac{7}{8}\right) = \frac{3}{4} - \frac{-7}{8}$
$= \frac{6}{8} - \frac{-7}{8}$
$= \frac{6-(-7)}{8}$
$= \frac{6+7}{8}$
$= \frac{13}{8} = 1\frac{5}{8}$

18. $1\frac{9}{16} + 4\frac{5}{8} = 1\frac{9}{16} + 4\frac{10}{16}$
$= 5\frac{19}{16} = 6\frac{3}{16}$

19. $28 = -7y$
$\frac{28}{-7} = \frac{-7y}{-7}$
$-4 = y$
The solution is –4.

20. $9\overline{)41}$ quotient 4, -36, remainder 5; $\frac{41}{9} = 4\frac{5}{9}$

21. $\frac{5}{14} - \frac{9}{42} = \frac{15}{42} - \frac{9}{42}$
$= \frac{6}{42} = \frac{1}{7}$

22. x^3y^4
$\left(\frac{7}{12}\right)^3\left(\frac{6}{7}\right)^4 = \frac{7}{12} \cdot \frac{7}{12} \cdot \frac{7}{12} \cdot \frac{6}{7} \cdot \frac{6}{7} \cdot \frac{6}{7} \cdot \frac{6}{7}$
$= \frac{7 \cdot 7 \cdot 7 \cdot 6 \cdot 6 \cdot 6 \cdot 6}{12 \cdot 12 \cdot 12 \cdot 7 \cdot 7 \cdot 7 \cdot 7}$
$= \frac{3}{28}$

23. $2a - (b-a)^2$
$2 \cdot 2 - (-3-2)^2 = 2 \cdot 2 - (-5)^2$
$= 2 \cdot 2 - 25$
$= 4 - 25 = 4 + (-25)$
$= -21$

24.
$$\begin{array}{r} 6,847 \\ 3,501 \\ +924 \\ \hline 11,272 \end{array}$$

25. $(x-y)^3 + 5x$
$(8-6)^3 + 5 \cdot 8 = 2^3 + 5 \cdot 8$
$= 8 + 5 \cdot 8$
$= 8 + 40$
$= 48$

26. $x + \frac{4}{5} = \frac{1}{4}$
$x + \frac{4}{5} - \frac{4}{5} = \frac{1}{4} - \frac{4}{5}$
$x = \frac{5}{20} - \frac{16}{20}$
$x = \frac{5-16}{20}$
$x = -\frac{11}{20}$
The solution is $-\frac{11}{20}$.

27. $89,357 \rightarrow 90,000$
$66,042 \rightarrow -70,000$
$ 20,000$

28. $-8 - (-12) - (-15) - 32$
$= -8 + 12 + 15 + (-32)$
$= 4 + 15 + (-32)$
$= 19 + (-32)$
$= -13$

29. $7\frac{3}{4} = \frac{(4 \cdot 7) + 3}{4}$
$= \frac{28+3}{4}$
$= \frac{31}{4}$

30. $5\overline{)35}$ quotient 7
$2\overline{)70}$
$2\overline{)140}$
$140 = 2 \cdot 2 \cdot 5 \cdot 7 = 2^2 \cdot 5 \cdot 7$

31. Strategy To determine how many more calories you would burn:
→Calculate the number of calories burned by bicycling at 12 mph for 4 h.
→Calculate the number of calories burned by walking at a rate of 3 mph for 5 h.
→Find the difference between the two calculations.

Solution Bicycling: $4 \cdot 410 = 1{,}640$
Walking: $320 \cdot 5 = 1{,}600$
$1{,}640 - 1{,}600 = 40$
You would burn 40 more calories by bicycling at 12 mph for 4 h.

32. Strategy To find the projected increase, subtract the population in 1990 (13,581,000) from the projected population in 2025 (15,322,000).

Solution $15{,}322{,}000 - 13{,}581{,}000 = 1{,}741{,}000$
The projected increase in population is 1,741,000 people.

33. Strategy To find the gain per share, subtract the purchase price $\left(27\frac{3}{8}\right)$ from the selling price $\left(38\frac{1}{4}\right)$.

Solution $38\frac{1}{4} - 27\frac{3}{8} = 38\frac{2}{8} - 27\frac{3}{8}$
$= 37\frac{10}{8} - 27\frac{3}{8}$
$= 10\frac{7}{8}$
The gain was $\$10\frac{7}{8}$ per share.

34. Strategy To find the length of fencing, substitute $16\frac{1}{2}$ for s in the given formula and solve for P.

Solution $P = 4s$
$P = 4 \cdot 16\frac{1}{2} = \frac{4}{1} \cdot \frac{33}{2}$
$P = \frac{132}{2} = 66$
The length of fencing needed is 66 ft.

35. Strategy To find the distance traveled, substitute $5\frac{1}{2}$ for r and $\frac{3}{4}$ for t in the given formula and solve for d.

Solution $d = rt$
$d = 5\frac{1}{2} \cdot \frac{3}{4}$
$d = \frac{11}{2} \cdot \frac{3}{4}$
$d = \frac{33}{8} = 4\frac{1}{8}$
The distance traveled is $4\frac{1}{8}$ miles.

Chapter 4

Section 4.1

Objective A Exercises, pages 241–242

1. The digit 5 is in the thousandths' place.
2. The digit 5 is in the tenths' place.
3. The digit 5 is in the ten-thousandths' place.
4. The digit 5 is in the hundred-thousandths' place.
5. The digit 5 is in the hundredths' place.
6. The digit 5 is in the millionths' place.
7. $\frac{3}{10}=0.3$ [three tenths]
8. $\frac{9}{10}=0.9$ [nine tenths]
9. $\frac{21}{100}=0.21$ [twenty-one hundredths]
10. $\frac{87}{100}=0.87$ [eighty-seven hundredths]
11. $\frac{461}{1{,}000}=0.461$ [four hundred sixty-one thousandths]
12. $\frac{853}{1{,}000}=0.853$ [eight hundred fifty-three thousandths]
13. $\frac{93}{1{,}000}=0.093$ [ninety-three thousandths]
14. $\frac{61}{1{,}000}=0.061$ [sixty-one thousandths]
15. $0.1=\frac{1}{10}$ [one tenth]
16. $0.3=\frac{3}{10}$ [three tenths]
17. $0.47=\frac{47}{100}$ [forty-seven hundredths]
18. $0.59=\frac{59}{100}$ [fifty-nine hundredths]
19. $0.289=\frac{289}{1{,}000}$ [two hundred eighty-nine thousandths]
20. $0.601=\frac{601}{1{,}000}$ [six hundred one thousandths]
21. $0.09=\frac{9}{100}$ [nine hundredths]
22. $0.013=\frac{13}{1{,}000}$ [thirteen thousandths]
23. thirty-seven hundredths
24. twenty-five and six tenths
25. nine and four tenths
26. one and four thousandths
27. fifty-three ten-thousandths
28. forty-one and one hundred eight thousandths
29. forty-five thousandths
30. three and one hundred fifty-seven thousandths
31. twenty-six and four hundredths
32. 0.672
33. 3.0806
34. 9.0407
35. 407.03
36. 612.704
37. 246.024
38. 2,067.9002
39. 73.02684

Objective B Exercises, page 242

40. $0.6 = 0.60$
    $0.16 < 0.60$
    $0.16 < 0.6$

41. $0.7 = 0.70$
$0.70 > 0.56$
$0.7 > 0.56$

42. $5.54 > 5.45$

43. $3.605 > 3.065$

44. $0.047 < 0.407$

45. $9.04 = 9.040$
$9.004 < 9.040$
$9.004 < 9.04$

46. $1.008 = 1.0080$
$1.0008 < 1.0080$
$1.0008 < 1.008$

47. $9.31 = 9.310$
$9.310 > 9.031$
$9.31 > 9.031$

48. $7.605 = 7.6050$
$7.6005 < 7.6050$
$7.6005 < 7.605$

49. $4.6 < 40.6$

50. $0.3152 = 0.31520$
$0.31502 < 0.31520$
$0.31502 < 0.3152$

51. $0.07046 > 0.07036$

52. 0.309, 0.390, 0.399
0.309, 0.39, 0.399

53. 0.609, 0.660, 0.696, 0.699
0.609, 0.66, 0.696, 0.699

54. 0.0024, 0.0240, 0.2040, 0.2400
0.0024, 0.024, 0.204, 0.24

55. 1.237, 1.327, 1.372, 1.732

56. 0.0061, 0.0590, 0.0600, 0.0610
0.0061, 0.059, 0.06, 0.061

57. 21.780, 21.805, 21,870, 21.875
21.78, 21.805, 21.87, 21.875

Objective C Exercises, page 243

58. 6.249 *Given place value*
$4 < 5$
6.249 rounded to the nearest tenth is 6.2.

59. 5.398 *Given place value*
$9 > 5$
5.398 rounded to the nearest tenth is 5.4.

60. 21.007 *Given place value*
$0 < 5$
21.007 rounded to the nearest tenth is 21.0.

61. 30.0092 *Given place value*
$0 < 5$
30.0092 rounded to the nearest tenth is 30.0.

62. 18.40937 *Given place value*
$9 > 5$
18.40937 rounded to the nearest hundredth is 18.41.

63. 413.5972 *Given place value*
$7 > 5$
413.5972 rounded to the nearest hundredth is 413.60.

64. 72.4983 *Given place value*
$8 > 5$
72.4983 rounded to the nearest hundredth is 72.50.

65. 6.061745 *Given place value*
$7 > 5$
6.061745 rounded to the nearest thousandth is 6.062.

66. 936.2905 *Given place value*
$5 = 5$
936.2905 rounded to the nearest thousandth is 936.291.

67. 96.8027 *Given place value*
$8 > 5$
96.8027 rounded to the nearest whole number is 97.

68. 47.3192 *Given place value*
$3 < 5$
47.3192 rounded to the nearest whole number is 47.

69. 5,439.83 *Given place value*
$8 > 5$
5,439.83 rounded to the nearest whole number is 5,440.

70. 7,014.96 *Given place value*
9 > 5

7,014.96 rounded to the nearest whole number is 7,015.

71. 0.023591 *Given place value*
9 > 5

0.023591 rounded to the nearest ten-thousandth is 0.0236.

72. 2.975268 *Given place value*
8 > 5

0.023591 rounded to the nearest ten-thousandth is 0.0236.

Objective D Exercises, pages 243–244

73. Strategy To find the weight, round 0.1763668 to the nearest hundredth.

Solution 0.1763668 rounded to the nearest hundredth is 0.18.
The weight of a nickel to the nearest hundredth is 0.18 oz.

74. Strategy To find the cost, round \$83.7188 to the nearest cent.

Solution \$83.7188 rounded to the nearest cent is \$83.72.
The total cost of the parka is \$83.72.

75. Strategy To find the distance, round 26.21875 to the nearest tenth.

Solution 26.21875 rounded to the nearest tenth is 26.2.
To the nearest tenth, the Boston Marathon is 26.2 mi.

76. Strategy To determine who had the greater average gain, compare Jurgensen's average gain (7.65) with Staubach's average gain (7.67).

Solution 7.67 > 7.65
Roger Staubach had the greater average gain.

77. Strategy To determine which country has the higher life expectancy, compare the numbers 75.3 and 75.5.

Solution 75.3 < 75.5
The average life expectancy is greater in Italy than in Great Britain.

78. Strategy To find on which day the British pound was worth more in American dollars, compare the numbers 1.506 and 1.513.

Solution 1.513 > 1.506
The British pound was worth more money in American dollars on Monday of that week.

79. Strategy To find the length, round 42.195 to the nearest tenth of a kilometer.

Solution 42.195 rounded to the nearest tenth of a kilometer is 42.2. To the nearest tenth of a kilometer, the marathon was 42.2 km.

80. Strategy
To find the minimum payment for each balance, compare each balance with the new balance in the table and read the corresponding minimum payment from the table.

Solution

a. \$20.01 < \$187.93 < \$200.00
The minimum required payment is \$20.00.

b. \$300.01 < \$342.55 < \$350.00
The minimum required payment is \$35.00.

c. \$250.01 < \$261.48 < \$300.00
The minimum required payment is \$30.00.

d. \$16.99 < \$20.00
The minimum required payment is \$16.99.

e. \$300.01 < \$310.00 < \$350.00
The minimum required payment is \$35.00.

f. \$20.01 < \$158.32 < \$200.00
The minimum required payment is \$20.00

g. \$200.01 < \$200.10 < \$250.00
The minimum required payment is \$25.00.

81. Strategy
To find the shipping and handling charges for each order, compare each amount ordered with the amounts in the table and read the corresponding shipping and handling charges from the table.

Solution

a. \$10.01 < \$12.42 < \$20.00
The shipping and handling charge is \$2.40.

b. \$20.01 < \$23.56 < \$30.00
The shipping and handling charge is \$3.60.

c. \$40.01 < \$47.80 < \$50.00
The shipping and handling charge is \$6.00.

d. \$66.91 > \$50.01
The shipping and handling charge is \$7.00.

e. \$30.01 < \$35.75 < \$40.00
The shipping and handling charge is \$4.70.

f. \$20.00 = \$20.00
The shipping and handling charge is \$2.40.

g. \$10.01 < \$18.25 < \$20.00
The shipping and handling charge is \$2.40.

Critical Thinking 4.1, page 244

82. a. The last zeros need not be entered on a calculator.

b. The first zero need not be entered on a calculator.

c. Both zeros must be entered on a calculator.

d. The first zero need not be entered on a calculator.

83. a. Answers will vary.
For example, 0.11, 0.12, 0.13, 0.14, 0.15, 0.16, 0.17, 0.18, and 0.19 are numbers between 0.1 and 0.2. But any number of digits can be attached to 0.1, and the number will be between 0.1 and 0.2. For example, 0.123456789 is a number between 0.1 and 0.2.

b. Answers will vary.
For example, 1.01, 1.02, 1.03, 1.04, 1.05, 1.06, 1.07, 1.08, and 1.09 are numbers between 1 and 1.1. But any number of digits can be attached to 1.0, and the number will be between 1 and 1.1. For example, 1.0123456789 is a number between 1 and 1.1.

c. Answers will vary.
For example, 0.001, 0.002, 0.003, and 0.004 are numbers between 0 and 0.005. But any number of digits can be attached to 0.001, 0.002, 0.003, or 0.004, and the number will be between 0 and 0.005. For example, 0.00123456789 is a number between 0 and 0.005.

Section 4.2

Objective A Exercises, pages 261–263

1.
$$\begin{array}{r} {\scriptstyle 1\ \ 11\ \ \ } \\ 1.864\ \ \ \\ 39 \\ +\ 25.0781 \\ \hline 65.9421 \end{array}$$

2.
$$\begin{array}{r} {\scriptstyle 1} \\ 2.04 \\ 35.6 \\ +\,4.918 \\ \hline 42.558 \end{array}$$

3.
$$\begin{array}{r} {\scriptstyle 2\,1} \\ 35.9 \\ 8.217 \\ +\,146.74 \\ \hline 190.857 \end{array}$$

4.
$$\begin{array}{r} {\scriptstyle 1\,1\,1} \\ 12 \\ 73.59 \\ +\,6.482 \\ \hline 92.072 \end{array}$$

5.
$$\begin{array}{r} 36.47 \\ -\,15.21 \\ \hline 21.26 \end{array}$$

6.
$$\begin{array}{r} 85.69 \\ -\,2.13 \\ \hline 83.56 \end{array}$$

7.
$$\begin{array}{r} {\scriptstyle 7\;9\;10} \\ 2\cancel{8}.\cancel{0}\cancel{0} \\ -\,6.74 \\ \hline 21.26 \end{array}$$

8.
$$\begin{array}{r} {\scriptstyle 4\;9\;9\;10} \\ \cancel{5}.\cancel{0}\cancel{0}\cancel{0} \\ -\,1.386 \\ \hline 3.614 \end{array}$$

9.
$$\begin{array}{r} {\scriptstyle 5\;9\;11\;10} \\ \cancel{6}.\cancel{0}\cancel{2}\cancel{0} \\ -\,3.252 \\ \hline 2.768 \end{array}$$

10. $0.92 - 0.0037 = 0.9163$

11. $-42.1 - 8.6 = -42.1 + (-8.6)$
$= -50.7$

12. $-6.57 - 8.933 = -6.57 + (-8.933)$
$= -15.503$

13. $5.73 - 9.042 = 5.73 + (-9.042)$
$= -3.312$

14. $-31.894 + 7.5 = -24.394$

15. $-9.37 + 3.465 = -5.905$

16. $1.09 - (-8.3) = 1.09 + 8.3$
$= 9.39$

17. $-19 - (-2.65) = -19 + 2.65$
$= -16.35$

18. $3.18 - 5.72 - 6.4$
$= 3.18 + (-5.72) + (-6.4)$
$= -2.54 + (-6.4)$
$= -8.94$

19. $-12.3 - 4.07 + 6.82$
$= -12.3 + (-4.07) + 6.82$
$= -16.37 + 6.82$
$= -9.55$

20. $-8.9 + 7.36 - 14.2$
$= -8.9 + 7.36 + (-14.2)$
$= -1.54 + (-14.2)$
$= -15.74$

21. $-5.6 - (-3.82) - 17.409$
$= -5.6 + 3.82 + (-17.409)$
$= -1.78 + (-17.409)$
$= -19.189$

22. $2.536 + 14.97 + 8.014 + 21.67$
$= 17.506 + 8.014 + 21.67$
$= 25.52 + 21.67$
$= 47.19$

23. $6.24 + 8.573 + 19.06 + 22.488$
$= 14.813 + 19.06 + 22.488$
$= 33.873 + 22.488$
$= 56.361$

24. $6.9217 - 3.4501 = 6.9217 + (-3.4501)$
$= 3.4716$

25. $62.57 - 8.9 = 62.57 + (-8.9)$
$= 53.67$

26. $5 - 1.63 = 5 + (-1.63)$
$= 3.37$

27. $-65.47 + (-32.91) = -98.38$

28. $382.9 + (-430.6) = -47.7$

29. $-138.72 - 510.64$
$= -138.72 + (-510.64) = -649.36$

30. $-6.82 - 4.793 = -6.82 + (-4.793)$
$= -11.613$

31. $-31 - (-62.09) = -31 + 62.09$
$= 31.09$

32. $$\begin{array}{rcr} 45.06 & \rightarrow & 50 \\ +80.71 & \rightarrow & +80 \\ \hline 125.77 & & 130 \end{array}$$

33. $$\begin{array}{rcr} 6.408 & \rightarrow & 6 \\ +5.917 & \rightarrow & +6 \\ \hline 12.325 & & 12 \end{array}$$

34. $$\begin{array}{rcr} 0.24 & \rightarrow & 0.2 \\ 0.38 & \rightarrow & 0.4 \\ +0.96 & \rightarrow & +1.0 \\ \hline 1.58 & & 1.6 \end{array}$$

35. $$\begin{array}{rcr} 56.87 & \rightarrow & 60 \\ -23.24 & \rightarrow & -20 \\ \hline 33.63 & & 40 \end{array}$$

36. $$\begin{array}{rcr} 6.272 & \rightarrow & 6 \\ -1.848 & \rightarrow & -2 \\ \hline 4.424 & & 4 \end{array}$$

37. $$\begin{array}{rcr} 0.931 & \rightarrow & 0.9 \\ -0.628 & \rightarrow & -0.6 \\ \hline 0.303 & & 0.3 \end{array}$$

38. $$\begin{array}{rcr} 5.37 & \rightarrow & 5 \\ +26.49 & \rightarrow & +30 \\ \hline 31.86 & & 35 \end{array}$$

39. $$\begin{array}{rcr} 87.65 & \rightarrow & 90 \\ -49.032 & \rightarrow & -50 \\ \hline 38.618 & & 40 \end{array}$$

40. $$\begin{array}{rcr} 387.6 & \rightarrow & 400 \\ -54.92 & \rightarrow & -50 \\ \hline 332.68 & & 350 \end{array}$$

41. **a.** $46.353 + 5.863 + 1.23 = 53.446$
The total children is 53.446 million.

b. $46.353 - 5.863 = 40.49$
There are 40.49 million more children in Public School.

42. $x + y$
$62.97 + (-43.85) = 19.12$

43. $x + y$
$5.904 + (-7.063) = -1.159$

44. $x + y$
$-125.41 + 361.55 = 236.14$

45. $x + y$
$-6.175 + (-19.49) = -25.665$

46. $x + y + z$
$41.33 + (-26.095) + 70.08$
$= 15.235 + 70.08$
$= 85.315$

47. $x + y + z$
$-6.059 + 3.884 + 15.71$
$= -2.175 + 15.71$
$= 13.535$

48. $x + y + z$
$81.72 + 36.067 + (-48.93)$
$= 117.787 + (-48.93)$
$= 68.857$

49. $x + y + z$
$-16.219 + 47 + (-2.3885)$
$= 30.781 + (-2.3885)$
$= 28.3925$

50. $x - y$
$43.29 - 18.76 = 43.29 + (-18.76)$
$= 24.53$

51. $x - y$
$6.029 - (-4.708) = 6.029 + 4.708$
$= 10.737$

52. $x - y$
$-16.329 - 4.54 = -16.329 + (-4.54)$
$= -20.869$

53. $x - y$
$-21.073 - 6.48 = -21.073 + (-6.48)$
$= -27.553$

54. $x - y$
$-3.69 - (-1.527) = -3.69 + 1.527$
$= -2.163$

55. $x - y$
$-8.21 - (-6.798) = -8.21 + 6.798$
$= -1.412$

56. $$\begin{array}{c|c} \multicolumn{2}{c}{6.4 = 5.2 + a} \\ \hline 6.4 & 5.2 + (-1.2) \end{array}$$
$6.4 \neq 4$
No, –1.2 is not a solution of the equation.

57. $$\begin{array}{r|l} \multicolumn{2}{c}{0.8 - p = 3.6} \\ \hline 0.8 - (-2.8) & 3.6 \\ 0.8 + 2.8 & 3.6 \end{array}$$
$3.6 = 3.6$
Yes, –2.8 is a solution of the equation.

58. $\begin{array}{c|c} x-0.5 & 1 \\ \hline -0.5-0.5 & 1 \end{array}$

$-1 \neq 1$

No, –0.5 is not a solution of the equation.

59. $\begin{array}{c|c} 27.4 & y-9.4 \\ \hline 27.4 & 36.8-9.4 \end{array}$

$27.4 = 27.4$

Yes, 36.8 is a solution of the equation.

Objective B Exercises, pages 263–264

60. $\begin{array}{r} 0.9 \\ \times\, 0.3 \\ \hline 0.27 \end{array}$

61. $\begin{array}{r} 3.4 \\ \times\, 0.5 \\ \hline 1.70 \end{array}$

62. $\begin{array}{r} 0.72 \\ \times\, 3.7 \\ \hline 504 \\ 2\,16 \\ \hline 2.664 \end{array}$

63. $\begin{array}{r} 8.29 \\ \times\, 0.004 \\ \hline 0.03316 \end{array}$

64. $-5.2(0.8) = -4.16$

65. $(-6.3)(-2.4) = 15.12$

66. $(1.9)(-3.7) = -7.03$

67. $-1.3(4.2) = -5.46$

68. $-8.1(-7.5) = 60.75$

69. $1.31(-0.006) = -0.00786$

70. $-10(0.59) = -5.9$

71. $(-100)(4.73) = -473$

72. $5.92 \cdot 100 = 592$

73. $1{,}000 \cdot 4.25 = 4{,}250$

74. $0.82 \cdot 10^2 = 82$

75. $6.71 \cdot 10^4 = 67{,}100$

76. $(2.7)(-16)(3.04) = (-43.2)(3.04)$
$= -131.328$

77. $(0.06)(-0.4)(-1.5) = (-0.024)(-1.5)$
$= 0.036$

78. $\begin{array}{rcr} 86.4 & \rightarrow & 90 \\ 4.2 & \rightarrow & \times\, 4 \\ & & \overline{360} \end{array}$

$86.4 \cdot 4.2 = 362.88$

79. $\begin{array}{rcr} 9.81 & \rightarrow & 10 \\ 0.77 & \rightarrow & \times\, 0.8 \\ & & \overline{8.0} \end{array}$

$9.81 \cdot 0.77 = 7.5537$

80. $\begin{array}{rcr} 0.238 & \rightarrow & 0.2 \\ 8.2 & \rightarrow & \times\, 8 \\ & & \overline{1.6} \end{array}$

$0.238 \cdot 8.2 = 1.9516$

81. $\begin{array}{rcr} 6.88 & \rightarrow & 7 \\ 9.97 & \rightarrow & \times\, 10 \\ & & \overline{70} \end{array}$

$6.88 \cdot 9.97 = 68.5936$

82. $\begin{array}{rcr} 8.432 & \rightarrow & 8 \\ 0.043 & \rightarrow & \times\, 0.04 \\ & & \overline{0.32} \end{array}$

$8.432 \cdot 0.043 = 0.362576$

83. $\begin{array}{rcr} 28.45 & \rightarrow & 30 \\ 1.13 & \rightarrow & \times\, 1 \\ & & \overline{30} \end{array}$

$28.45 \cdot 1.13 = 32.1485$

84. $5{,}000(9.64) = 48{,}200$
48,200 Mexican pesos would be exchanged for 5,000 U.S. dollars.

85. $15{,}000(108.3) = 1{,}624{,}500$
1,624,500 Japanese yen would be exchanged for 15,000 U.S. dollars.

86. xy
$5.68 \cdot 0.2 = 1.136$

87. ab
$6.27 \cdot 8 = 50.16$

88. $40c$
$40 \cdot 2.5 = 100$

89. $10t$
$10(-4.8) = -48$

90. xy
$(-3.71)(2.9) = -10.759$

91. ab
$(0.379)(-0.22) = -0.08338$

92. ab
$452(-0.86) = -388.72$

93. cd
$(-2.537)(-9.1) = 23.0867$

94. cd
$(-4.259)(-6.3) = 26.8317$

95. $1.6 = -0.2z$
$$\begin{array}{c|c} 1.6 & -0.2(-8) \end{array}$$
$1.6 = 1.6$
Yes, -8 is a solution of the equation.

96. $-7.9c = -7.9$
$$\begin{array}{c|c} -7.9(-1) & -7.9 \end{array}$$
$7.9 \neq -7.9$
No, -1 is not a solution of the equation.

97. $-83.25r = 8.325$
$$\begin{array}{c|c} -83.25(-10) & 8.325 \end{array}$$
$832.5 \neq 8.325$
No, -10 is not a solution of the equation.

98. $32.4 = -9w$
$$\begin{array}{c|c} 32.4 & -9(-3.6) \end{array}$$
$32.4 = 32.4$
Yes, -3.6 is a solution of the equation.

Objective C Exercises, pages 265–266

99.
$$\begin{array}{r} 32.3 \\ 0.5\overline{)\,16.15} \\ \underline{-15} \\ 11 \\ \underline{-10} \\ 15 \\ \underline{-15} \\ 0 \end{array}$$

100.
$$\begin{array}{r} 1.95 \\ 3.6\overline{)\,7.020} \\ \underline{-3.6} \\ 342 \\ \underline{-324} \\ 180 \\ \underline{-180} \\ 0 \end{array}$$

101. $27.08 \div (-0.4) = -67.7$

102. $-8.919 \div 0.9 = -9.91$

103. $(-3.312) \div (-0.8) = 4.14$

104. $84.66 \div (-1.7) = -49.8$

105. $-2.501 \div 0.41 = -6.1$

106. $1.003 \div (-0.59) = -1.7$

107. $55.63 \div 8.8 \approx 6.3$

108. $1.873 \div 1.4 \approx 1.3$

109. $(-52.8) \div (-9.1) \approx 5.8$

110. $(-6.824) \div 0.053 \approx -128.8$

111. $6.457 \div 8 \approx 0.81$

112. $19.07 \div 0.54 \approx 35.31$

113. $0.0416 \div (-0.53) \approx -0.08$

114. $(-31.792) \div (-0.86) \approx 36.97$

115. $52.78 \div 10 = 5.278$

116. $37{,}942 \div 1{,}000 = 37.942$

117. $48.05 \div 10^2 = 0.4805$

118. $9.407 \div 10^3 = 0.009407$

119. $-19.04 \div 0.75 \approx -25.4$

120. $-21.892 \div (-0.96) \approx 22.8$

121. $27.735 \div (-60.3) \approx -0.5$

122. $-13.97 \div 28.4 \approx -0.5$

123. $42.43 \rightarrow 40$
$3.8 \rightarrow 4$
$40 \div 4 = 10$
$42.43 \div 3.8 \approx 11.17$

124. $678 \rightarrow 700$
$0.71 \rightarrow 0.7$
$700 \div 0.7 = 1{,}000$
$678 \div 0.71 \approx 954.93$

125. $6.398 \rightarrow 6$
$5.5 \rightarrow 6$
$6 \div 6 = 1$
$6.398 \div 5.5 \approx 1.16$

126. $0.994 \rightarrow 1$
$0.456 \rightarrow 0.5$
$1 \div 0.5 = 2$
$0.994 \div 0.456 \approx 2.18$

127. $1.237 \rightarrow 1$
$0.021 \rightarrow 0.02$
$1 \div 0.02 = 50$
$1.237 \div 0.021 \approx 58.90$

128. $421.093 \rightarrow 400$
$4.087 \rightarrow 4$
$400 \div 4 = 100$
$421.093 \div 4.087 \approx 103.03$

129. $33.14 \rightarrow 30$
$4.6 \rightarrow 5$
$30 \div 5 = 6$
$33.14 \div 4.6 \approx 7.20$

130. $129.38 \rightarrow 100$
$4.47 \rightarrow 4$
$100 \div 4 = 25$
$129.38 \div 4.47 \approx 28.94$

131. $9.9 \div 4.0 \approx 2.5$
DSL's market is 2.5 times greater in 2003 than 2001.

132. $\frac{x}{y}$
$\frac{52.8}{0.4} = 52.8 \div 0.4 = 132$

133. $\frac{x}{y}$
$\frac{3.542}{0.7} = 3.542 \div 0.7 = 5.06$

134. $\frac{x}{y}$
$\frac{-2.436}{0.6} = -2.436 \div 0.6 = -4.06$

135. $\frac{x}{y}$
$\frac{0.648}{-2.7} = 0.648 \div (-2.7) = -0.24$

136. $\frac{x}{y}$
$\frac{26.22}{-6.9} = 26.22 \div (-6.9) = -3.8$

137. $\frac{x}{y}$
$\frac{-8.034}{-3.9} = (-8.034) \div (-3.9) = 2.06$

138. $\frac{x}{y}$
$\frac{-64.05}{-6.1} = (-64.05) \div (-6.1) = 10.5$

139. $\frac{x}{y}$
$\frac{-2.501}{0.41} = -2.501 \div 0.41 = -6.1$

140. $\frac{x}{y}$
$\frac{1.003}{-0.59} = 1.003 \div (-0.59) = -1.7$

141. $\frac{q}{-8} = -3.1$
$\begin{array}{c|c} \frac{24.8}{-8} & -3.1 \end{array}$
$-3.1 = -3.1$
Yes, 24.8 is a solution of the equation.

142. $\frac{-6}{z} = -12.5$
$\begin{array}{c|c} \frac{-6}{0.48} & -12.5 \end{array}$
$-12.5 = -12.5$
Yes, 0.48 is a solution of the equation.

143. $21 = \frac{t}{0.4}$
$\begin{array}{c|c} 21 & \frac{-8.4}{0.4} \end{array}$
$21 \approx -21$
No, −8.4 is not a solution of the equation.

144. $\frac{-2.7}{a} = \frac{a}{-0.3}$
$\begin{array}{c|c} \frac{-2.7}{-0.9} & \frac{-0.9}{-0.3} \end{array}$
$3 = 3$
Yes, −0.9 is a solution of the equation.

Objective D Exercises, pages 266–267

145. $8\overline{)3.000}$ = 0.375
$\frac{3}{8} = 0.375$

146. $\begin{array}{r} 0.466 \\ 15\overline{)7.000} \end{array}$

$\frac{7}{15} = 0.4\overline{6}$

147. $\begin{array}{r} 0.7272 \\ 11\overline{)8.0000} \end{array}$

$\frac{8}{11} = 0.\overline{72}$

148. $\begin{array}{r} 0.5625 \\ 16\overline{)9.0000} \end{array}$

$\frac{9}{16} = 0.5625$

149. $\begin{array}{r} 0.58333 \\ 12\overline{)7.00000} \end{array}$

$\frac{7}{12} = 0.58\overline{3}$

150. $\begin{array}{r} 1.666 \\ 3\overline{)5.000} \end{array}$

$\frac{5}{3} = 1.\overline{6}$

151. $\begin{array}{r} 1.75 \\ 4\overline{)7.00} \end{array}$

$\frac{7}{4} = 1.75$

152. Write $\frac{3}{4}$ as a decimal.

$\begin{array}{r} 0.75 \\ 4\overline{)3.00} \end{array}$

$2\frac{3}{4} = 2.75$

153. Write $\frac{1}{2}$ as a decimal.

$\begin{array}{r} 0.5 \\ 2\overline{)1.0} \end{array}$

$1\frac{1}{2} = 1.5$

154. Write $\frac{2}{9}$ as a decimal.

$\begin{array}{r} 0.222 \\ 9\overline{)2.000} \end{array} = 0.\overline{2}$

$3\frac{2}{9} = 3.\overline{2}$

155. Write $\frac{1}{6}$ as a decimal.

$\begin{array}{r} 0.1666 \\ 6\overline{)1.0000} \end{array} = 0.1\overline{6}$

$4\frac{1}{6} = 4.1\overline{6}$

156. $\begin{array}{r} 0.12 \\ 25\overline{)3.00} \end{array}$

$\frac{3}{25} = 0.12$

157. Write $\frac{1}{4}$ as a decimal.

$\begin{array}{r} 0.25 \\ 4\overline{)1.00} \end{array}$

$2\frac{1}{4} = 2.25$

158. Write $\frac{3}{5}$ as a decimal.

$\begin{array}{r} 0.6 \\ 5\overline{)3.0} \end{array}$

$6\frac{3}{5} = 6.6$

159. Write $\frac{8}{9}$ as a decimal.

$\begin{array}{r} 0.888 \\ 9\overline{)8.000} \end{array} = 0.\overline{8}$

$3\frac{8}{9} = 3.\overline{8}$

160. $0.6 = \frac{6}{10} = \frac{3}{5}$

161. $0.2 = \frac{2}{10} = \frac{1}{5}$

162. $0.25 = \frac{25}{100} = \frac{1}{4}$

163. $0.75 = \frac{75}{100} = \frac{3}{4}$

164. $0.48 = \frac{48}{100} = \frac{12}{25}$

165. $0.125 = \frac{125}{1{,}000} = \frac{1}{8}$

166. $0.325 = \frac{325}{1{,}000} = \frac{13}{40}$

167. $2.5 = 2\frac{5}{10} = 2\frac{1}{2}$

168. $3.4 = 3\frac{4}{10} = 3\frac{2}{5}$

169. $4.55 = 4\frac{55}{100} = 4\frac{11}{20}$

170. $9.95 = 9\frac{95}{100} = 9\frac{19}{20}$

171. $1.72 = 1\frac{72}{100} = 1\frac{18}{25}$

172. $5.68 = 5\frac{68}{100} = 5\frac{17}{25}$

173. $0.045 = \frac{45}{1,000} = \frac{9}{200}$

174. $0.085 = \frac{85}{1,000} = \frac{17}{200}$

175. $\frac{9}{10} = 0.90$
$0.90 > 0.89$
$\frac{9}{10} > 0.89$

176. $\frac{7}{20} = 0.35$
$0.35 > 0.34$
$\frac{7}{20} > 0.34$

177. $\frac{4}{5} = 0.800$
$0.800 < 0.803$
$\frac{4}{5} < 0.803$

178. $\frac{3}{4} = 0.750$
$0.750 > 0.706$
$\frac{3}{4} > 0.706$

179. $\frac{4}{9} = 0.\overline{444}$
$0.444 < 0.\overline{444}$
$0.444 < \frac{4}{9}$

180. $\frac{5}{7} \approx 0.71$
$0.72 > 0.71$
$0.72 > \frac{5}{7}$

181. $\frac{3}{25} = 0.12$
$0.13 > 0.12$
$0.13 > \frac{3}{25}$

182. $\frac{13}{50} = 0.26$
$0.25 < 0.26$
$0.25 < \frac{13}{50}$

183. $\frac{5}{16} = 0.3125$
$0.3125 > 0.3120$
$\frac{5}{16} > 0.312$

184. $\frac{7}{18} = 0.3\bar{8}$
$0.3\bar{8} < 0.39$
$\frac{7}{18} < 0.39$

185. $\frac{10}{11} = 0.9\overline{09}$
$0.9\overline{09} > 0.909$
$\frac{10}{11} > 0.909$

186. $\frac{8}{15} = 0.53\bar{3}$
$0.53\bar{3} < 0.543$
$\frac{8}{15} < 0.543$

Objective E Exercises, pages 267–272

187. Strategy: To find your monthly salary, divide your annual salary (41,619) by 12.

Solution: $41,619 \div 12 = 3,468.25$
Your monthly salary is \$3,468.25.

188. Strategy: To find the amount of each payment, divide the yearly payment (947.60) by 4.

Solution: $947.60 \div 4 = 236.90$
Each payment for car insurance is \$236.90.

189. Strategy To find the temperature fall during the 27-minute period, subtract the final temperature (–20) from the initial temperature (12.22).

Solution $12.22 - (-20) = 12.22 + 20$
$= 32.22$
The temperature dropped 32.22°C during the 27-minute period.

190. Strategy To find how many degrees the temperature fell, subtract the lower temperature (–13.33) from the higher temperature (12.78).

Solution $12.78 - (-13.33)$
$= 12.78 + 13.33 = 26.11$
The temperature fell 26.11°C during the 15-minute period.

191. Strategy To find the cost per can, divide the total cost (6.79) by the number of cans (24).

Solution $6.79 \div 24 \approx 0.28$
A diet cola costs approximately $0.28 per can.

192. Strategy To find the number of miles, divide the total distance traveled (295) by the number of gallons (12.5).

Solution $295 \div 12.5 = 23.6$
You can travel 23.6 mi on each gallon of gas.

193. Strategy To find the cost to operate the motor, multiply the number of hours operating the motor (90) times the cost per hour (0.038).

Solution $90 \cdot 0.038 = 3.42$
The cost to run the motor is $3.42.

194. Strategy To find the cost per mile, divide the total cost (5.60) by the number of miles (136).

Solution $5.60 \div 136 \approx 0.04$
The cost per mile was $0.04.

195. Strategy To find the amount deductible, multiply number of miles (11,842) by the standard deduction per mile for 2000 tax return (0.31).

Solution $11{,}842 \cdot 0.31 \approx 3{,}671.02$
The amount deductible was $3,671.02.

196. Strategy To estimate the cost of the diskettes:
→Find the cost of one box of diskettes from the given table. Round this value.
→Multiply the rounded value by 4.

Solution $5.90 \rightarrow 6.00$
$6.00 \cdot 4 = 24.00$
The estimated cost of 4 boxes of diskettes is $24.00.

197. Strategy To estimate the cost of the diskettes:
→Find the cost of one box of diskettes from the given table. Round this value.
→Multiply the rounded value by 6.

Solution $19.50 \rightarrow 20.00$
$20.00 \cdot 6 = 120.00$
The estimated cost of 6 boxes of diskettes is $120.00.

198. Strategy To find the total cost of the camcorder:
→Find the total amount of the payment by multiplying the amount of each payment (34.17) by the number of payments (18).
→Add the total amount of the payments to the down payment (225).

Solution $34.17 \cdot 18 = 615.06$
$615.06 + 225 = 840.06$
The total cost of the camcorder was $840.06.

199. Strategy To find the amount remaining in the budget:
→Add the amounts already spent.
→Subtract the amount already spent from the budget (810).

Solution
$$\begin{array}{r} 22.78 \\ 64.93 \\ 15.50 \\ 160 \\ +\,91.62 \\ \hline 354.83 \end{array}$$
$$\begin{array}{r} 810.00 \\ -\,354.83 \\ \hline 455.17 \end{array}$$
You have $455.17 remaining in the budget.

200. Strategy To find the new balance:
→Add the amount of the deposit (189.53) to the old balance (347.80).
→Subtract the amount of the check (62.89) from the sum

Solution $347.08 + 189.53 = 536.61$
$536.61 - 62.89 = 473.72$
The new balance is $473.72

201. Strategy To find the bookkeeper's total income:
→Find the amount of overtime pay by multiplying the hours of overtime (6) by the overtime rate (12.75).
→Add the overtime pay to the regular salary (340).

Solution $6 \cdot 12.75 = 76.50$
$76.50 + 340 = 416.50$
The bookkeeper's total income for the week is $416.50.

202. Strategy To find the number of hours:
→Subtract the number of hours used by a 5th grader (4.2) from the number of hours used by a 2nd grader (4.9).
→Multiply the difference in the hours by the weeks per year (52).

Solution $4.9 - 4.2 = 0.7$
$0.7 \cdot 52 = 36.4$
A 2nd grade student spends 36.4 more hours per year using a computer.

203. Strategy To estimate the bill, estimate the following items and then add the estimated values: soup (2.75), cheese sticks (3.25), swordfish (16.95), chicken divan (14.95), and carrot cake (4.25).

Solution
$$\begin{array}{rcr} 2.75 & \rightarrow & 3.00 \\ 3.25 & \rightarrow & 3.00 \\ 16.95 & \rightarrow & 20.00 \\ 14.95 & \rightarrow & 10.00 \\ 4.25 & \rightarrow & +4.00 \\ \cline{3-3} & & 40.00 \end{array}$$
The bill is approximately $40.00

204. Strategy To estimate the bill, estimate the following items and then add the estimated values: potato skins (3.50), cheese sticks (3.25), prime rib (18.95), chicken divan (14.95), ice cream pie (5.50), and cheese cake (6.75).

Solution

$$\begin{array}{rcr} 3.50 & \rightarrow & 4.00 \\ 3.25 & \rightarrow & 3.00 \\ 18.95 & \rightarrow & 20.00 \\ 14.95 & \rightarrow & 10.00 \\ 5.50 & \rightarrow & 6.00 \\ 6.75 & \rightarrow & +7.00 \\ \hline & & 50.00 \end{array}$$

The bill is approximately $50.00.

205. Strategy

a. To determine if life expectancy has increased for both males and females between each 10-year period shown in the graph, see if the numbers increase from left to right along each of the lines in the graph.

b. To determine whether males or females had a longer life expectancy, compare the life expectancy for males in 1990 with the life expectancy for females in 1990. To find the difference in the life expectancy, subtract the smaller of the two numbers from the larger.

c. To determine during which year the difference between male and female life expectancy was greatest, subtract the lower life expectancy from the higher for each year shown in the graph. Find the largest difference.

Solution

a. The numbers along each of the lines in the graph increase from left to right. Life expectancy has increased for both males and females between each 10-year period shown in the graph.

b. $78.6 > 71.8$
Females had a longer life expectancy.
$78.6 - 71.8 = 6.8$
Female life expectancy was longer by 6.8 years.

c. 1900: $49.6 - 49.1 = 0.5$
1910: $53.7 - 50.2 = 3.5$
1920: $56.3 - 54.6 = 1.7$
1930: $61.4 - 58.0 = 3.4$
1940: $65.3 - 60.9 = 4.4$
1950: $70.9 - 65.3 = 5.6$
1960: $73.2 - 66.6 = 6.6$
1970: $74.8 - 67.1 = 7.7$
1980: $77.5 - 69.9 = 7.6$
1990: $78.6 - 71.8 = 6.8$
7.7 is the largest difference.
The difference between male and female life expectancy was greatest in 1970.

206. Strategy To find the profit:
→Convert 5 L to milliliters.
→Find the number of bottles by dividing the number of milliliters by 250.
→Find the total cost by multiplying the number of bottles by 0.25 and adding to 65.
→Find the income by multiplying the number of bottles by 5.89.
→Find the profit by subtracting the cost from the income.

Solution $5\text{ L} = 5{,}000\text{ ml}$
$5{,}000 \div 250 = 20$
$20 \cdot 0.25 + 65 = 5 + 65 = 70$
$20 \cdot 5.89 = 117.80$
$117.80 - 70 = 47.80$
The profit for the cough syrup was $47.80.

207. Strategy To find the number of pounds discarded, multiply the number of pounds per person (3.6) by the number of people in the family (4) by the number of days in one year (365).

Solution $3.6(4)(365) = 14.4(365)$
$= 5{,}256$
On average, a family of four discards 5,256 lb of garbage each year.

208. Strategy

a. To determine which year the balance was lowest, look at the chart for the lowest negative number. For the highest balance, look at the chart for the highest negative number.

b. To determine the difference in the trade balances, subtract the balance from 1993 from the balance in 1999.

c. To determine the greatest difference, add the balances for each pair of consecutive years and compare the sums.

d. To determine how many times greater the trade balance was, divide the balance from 1993 by the balance in 1999. Round to the nearest whole number.

e. To determine the average trade balance per quarter in 1996, divide the trade balance for 1996 by four.

Solution

a. The lowest trade balance was in 1999. The highest trade balance was in 1993.

b. $-331.945-(-115.611)=216.334$
The difference in trade balances is \$216.334 billion.

c. $-115.611+(-151.414)=-267.025$
$-151.414+(-160.474)=-311.888$
$-160.474+(-168.488)=-328.962$
$-168.488+(-182.615)=-351.103$
$-182.615+(-233.411)=-416.026$
$-233.411+(-331.945)=-565.356$
The highest trade balance was in 1998–1999.

d. $-331.945\div(-115.611)\approx 2.8712\approx 3.$
The trade balance in 1999 was 3 times greater than the trade balance in 1993.

e. $-168.488\div 4=-42.122.$
The average trade balance per quarter in 1996 was \$42.122 billion.

f. Answers will vary.

209. Strategy To find the perimeter, substitute 4.5 for L and 3.25 for W in the formula below and solve for P.

Solution
$P=2L+2W$
$P=2\cdot 4.5+2\cdot 3.25$
$=9+6.5=15.5$
The perimeter is 15.5 in.

210. Strategy To find the perimeter, substitute 6.4 for L and 2.8 for W in the formula below and solve for P.

Solution
$P=2L+2W$
$P=2\cdot 6.4+2\cdot 2.8$
$=12.8+5.6=18.4$
The perimeter is 18.4 m.

211. Strategy To find the area, substitute 4.5 for L and 3.25 for W in the formula below and solve for A.

Solution
$A=LW$
$A=4.5\cdot 3.25=14.625$
The area is 14.625 in^2.

212. Strategy To find the area, substitute 7.8 for L and 4.6 for W in the formula below and solve for A.

Solution
$A=LW$
$A=7.8\cdot 4.6=35.88$
The area is 35.88 cm^2.

213. Strategy To find the perimeter, substitute 2.8, 4.75, and 6.4 for a, b, and c in the formula below and solve for P.

Solution
$P=a+b+c$
$P=2.8+4.75+6.4=13.95$
The perimeter is 13.95 m.

214. Strategy To find the perimeter, substitute 7.5, 6.1, and 4.9 for a, b, and c in the formula below and solve for P.

Solution
$P=a+b+c$
$P=7.5+6.1+4.9=18.5$
The perimeter is 18.5 m.

215. Strategy To find the perimeter, substitute 3.5 for s in the formula below and solve for P.

Solution $P = 4s$
$P = 4 \cdot 3.5 = 14$
The perimeter is 14 ft.

216. Strategy To find the markup, substitute 2,231.81 for S and 1.653.19 for C in the given formula and solve for M.

Solution $M = S - C$
$M = 2{,}231.81 - 1{,}653.19$
$M = 578.62$
The markup is \$578.62.

217. Strategy To find the employee's federal earnings, substitute 694.89 for E and 132.69 for W in the given formula and solve for F.

Solution $F = E - W$
$F = 694.89 - 132.69$
$F = 562.20$
The federal earnings are \$562.20.

218. Strategy To find the cost per mile, substitute 260.16 for C and 542 for N in the given formula and solve for N.

Solution $M = \frac{C}{N}$
$M = \frac{260.16}{542}$
$M = 0.48$
The rental car costs \$.48 per mile.

219. Strategy To find the force on the falling object, substitute 4.25 for m and –9.80 for g in the given formula and solve for F.

Solution $F = ma$
$F = 4.25(-9.80)$
$F = -41.65$
The force on the object is –41.65 newtons.

220. Strategy To find the cost of operating the TV, substitute 1,800 for w, 5 for t, and 0.06 for k in the given formula and solve for c.

Solution $c = \frac{1}{1{,}000} wtk$
$c = \frac{1}{1{,}000}(1{,}800)(5)(0.06)$
$c = 0.54$
The cost of operating the TV is \$0.54.

221. Strategy To find the equity, replace V by 125,000 and L by 67,853.25 in the given formula and solve for E.

Solution $E = V - L$
$E = 125{,}000 - 67{,}853.25$
$E = 57{,}146.75$
The equity on the home is \$57,146.75.

222. The largest amount by which the estimate of the sum could differ from the exact sum is 0.098.
For example, 0.149 is the largest three-place decimal that would be rounded down to 0.1.
The exact sum of 0.149 and 0.149 is 0.298.
To estimate the sum of 0.149 and 0.149, we would round each number to 0.1, and 0.1 + 0.1 = 0.2.
The difference between 0.298 and 0.2 is 0.098.
0.151 is the smallest three-place decimal that would be rounded up to 0.2.
The exact sum of 0.151 and 0.151 is 0.302.
To estimate the sum of 0.151 and 0.151, we would round each number to 0.2, and 0.2 + 0.2 = 0.4.
The difference between 0.4 and 0.302 is 0.098.
If one addend is rounded up and the other rounded down, the difference will be less than 0.098.

Critical Thinking 4.2, page 272

223. **a.** $(1.1)^3 = 1.331$
$1.331 > 1.31$
$(1.1)^3 > 1.31$

b. $(0.9)^3 = 0.729$
$1^5 = 1$
$0.729 < 1$
$(0.9)^3 < 1^5$

c. $(1.2)^3 = 1.728$
$(0.8)^3 = 0.512$
$1.728 > 0.512$
$(1.2)^3 > (0.8)^3$

224. $(1.0035)(1.00079) = 1.004292765$
A calculator may truncate the product to 1.0042927 or round the product to 1.0042928.
If the decimal places in a negative number are truncated, the resulting number is greater than the original number. For example, if the number –2.00000009 is truncated to –2.0000000, the truncated number is greater than the original.
$-2.0000000 > -2.00000009$

225. \$31.93 = 3193¢
Find the whole number factors of 3193.
The prime factorization of 3193 is $31 \cdot 103$.
The number of cents charged per pen must be less than 50, since the price was reduced.
The factor 103 is not less than 50.
Therefore, the price of the pen was reduced to 31¢.

226. a. The product of two negative factors is a positive number.
An even number is a number that is a multiple of 2.
When multiplying an even number of negative factors, we will always be multiplying products of two negative factors.
The product will always be positive.
The statement is never true.

b. The sum of any number of negative addends is a negative number.
The statement is always true.

c. The statement $a \geq 0$ means that a is a positive number or 0.
The absolute value of a positive number is the number. The absolute value of 0 is 0.
The statement is always true.

d. The statement $a < 0$ means that a is a negative number or 0.
The absolute value of a negative number is the opposite of the number. The absolute value of 0 is 0.
$-a$ is the opposite of a.
The statement is always true.

Section 4.3

Objective A Exercises, page 275

1. $y + 3.96 = 8.45$
$y + 3.96 - 3.96 = 8.45 - 3.96$
$y = 4.49$
The solution is 4.49.

2. $x - 2.8 = 1.34$
$x - 2.8 + 2.8 = 1.34 + 2.8$
$x = 4.14$
The solution is 4.14.

3. $-9.3 = c - 15$
$-9.3 + 15 = c - 15 + 15$
$5.7 = c$
The solution is 5.7.

4. $-28 = x - 3.27$
$-28 + 3.27 = x - 3.27 + 3.27$
$-24.73 = x$
The solution is –24.73.

5. $7.3 = -\frac{n}{1.1}$
$-1.1(7.3) = -1.1\left(-\frac{n}{1.1}\right)$
$-8.03 = n$
The solution is –8.03.

6. $-5.1 = \frac{y}{3.2}$
$3.2(-5.1) = 3.2 \cdot \frac{y}{3.2}$
$-16.32 = y$
The solution is –16.32.

7. $-7x = 8.4$
$\frac{-7x}{-7} = \frac{8.4}{-7}$
$x = -1.2$
The solution is –1.2.

8. $1.44 = -0.12\,t$
$\frac{1.44}{-0.12} = \frac{-0.12t}{-0.12}$
$-12 = t$
The solution is –12.

9. $y - 0.234 = -0.09$
$y - 0.234 + 0.234 = -0.09 + 0.234$
$y = 0.144$
The solution is 0.144.

10. $9 = z + 0.98$
$9 - 0.98 = z + 0.98 - 0.98$
$8.02 = z$
The solution is 8.02.

11. $6.21r = -1.863$
$\frac{6.21r}{6.21} = \frac{-1.863}{6.21}$
$r = -0.3$

12. $-78.1a = 85.91$
$\frac{-78.1a}{-78.1} = \frac{85.91}{-78.1}$
$a = -1.1$
The solution is –1.1.

13. $-0.001 = x + 0.009$
$-0.001 - 0.009 = x + 0.009 - 0.009$
$-0.01 = x$
The solution is –0.01.

14. $5 = 43.5 + c$
$5 - 43.5 = 43.5 - 43.5 + c$
$-38.5 = c$
The solution is –38.5

15. $\frac{x}{2} = -0.93$
$2 \cdot \frac{x}{2} = 2(-0.93)$
$x = -1.86$
The solution is –1.86.

16. $-1.03 = -\frac{z}{3}$
$-3(-1.03) = -3\left(-\frac{z}{3}\right)$
$3.09 = z$
The solution is 3.09.

17. $-9.85y = 2.0685$
$\frac{-9.85y}{-9.85} = \frac{2.0685}{-9.85}$
$y = -0.21$
The solution is –0.21.

18. $7w = -0.014$
$\frac{7w}{7} = \frac{-0.014}{7}$
$w = -0.002$
The solution is –0.002.

19. $-6v = 15$
$\frac{-6v}{-6} = \frac{15}{-6}$
$v = -2.5$
The solution is –2.5.

20. $-55 = -40x$
$\frac{-55}{-40} = \frac{-40x}{-40}$
$1.375 = x$
The solution is 1.375.

21. $0.908 = 2.913 + x$
$0.908 - 2.913 = 2.913 - 2.913 + x$
$-2.005 = x$
The solution is –2.005.

22. $-76.51 = y - 43.9$
$-76.51 + 43.9 = y - 43.9 + 43.9$
$-32.61 = y$
The solution is –32.61.

23. $\frac{t}{-2.1} = -7.8$
$-2.1\left(\frac{t}{-2.1}\right) = -2.1(-7.8)$
$t = 16.38$
The solution is 16.38.

24. $\frac{w}{0.02} = -9.64$
$0.02 \cdot \frac{w}{0.02} = 0.02(-9.64)$
$w = -0.1928$
The solution is –0.1928.

Objective B Exercises, pages 275–276

25. Strategy: To find the selling price of the calendar, replace P by 3.50 and C by 5.23 in the given formula and solve for S.

Solution:
$P = S - C$
$3.50 = S - 5.23$
$3.50 + 5.23 = S - 5.23 + 5.23$
$8.73 = S$
The selling price of the calendar should be $8.73.

26. Strategy: To find the total cost, replace M by 0.23 and N by 25,000 in the given formula and solve for C.

Solution:
$M = \frac{C}{N}$
$0.23 = \frac{C}{25{,}000}$
$25{,}000(0.23) = 25{,}000 \cdot \frac{C}{25{,}000}$
$5{,}750 = C$
The total cost of operating the car is $5,750.

27. Strategy: To find the velocity, replace a by 16 and t by 6.3 in the given formula and solve for v.

Solution:
$a = \frac{v}{t}$
$16 = \frac{v}{6.3}$
$6.3(16) = 6.3 \cdot \frac{v}{6.3}$
$100.8 = v$
The velocity is 100.8 ft/s.

28. Strategy To find the stockholders equity, replace A by 34.8 and L by 29.9 in the given formula and solve for S.

Solution
$A = L + S$
$34.8 = 29.9 + S$
$34.8 - 29.9 = 29.9 - 29.9 + S$
$4.9 = S$
The stockholders equity is \$4.9 million.

29. Strategy To find the cost per kilowatt-hour, replace c by 0.01, w by 1,000 and t by 4 in the given formula and solve for k.

Solution
$c = \dfrac{wtk}{1{,}000}$
$0.01 = \dfrac{1{,}000 \cdot 4 \cdot k}{1{,}000}$
$0.01 = 4k$
$\dfrac{0.01}{4} = \dfrac{4k}{4}$
$0.0025 = k$
The cost per kilowatt-hour is \$0.0025.

30. Strategy To find the selling price, write and solve an equation using x to represent the selling price.

Solution
the markup	equals	the difference between the selling price and the cost

$1.73 = x - 3.27$
$1.73 + 3.27 = x - 3.27 + 3.27$
$5.00 = x$
The selling price is \$5.

31. Strategy To find the monthly lease payment, write and solve an equation using x to represent the monthly lease payment.

Solution
the total of the monthly payments	is	the product of the number of months of the lease and the monthly lease payment

$15{,}387 = 60x$
$\dfrac{15{,}387}{60} = \dfrac{60x}{60}$
$256.45 = x$
The monthly lease payment is \$256.45.

32. Strategy To find the length, substitute 210 for A and 10.5 for W in the formula below and solve for L.

Solution
$A = LW$
$210 = L \cdot 10.5$
$\dfrac{210}{10.5} = \dfrac{10.5L}{10.5}$
$L = 20$
The length is 20 in.

33. Strategy To find the width, substitute 225 for A and 18 for L in the formula below and solve for W.

Solution
$$A = LW$$
$$225 = 18 \cdot W$$
$$\frac{225}{18} = \frac{18W}{18}$$
$$W = 12.5$$
The width is 12.5 ft.

34. Strategy To find the length, substitute 33 for P in the formula below and solve for s.

Solution
$$P = 4s$$
$$33 = 4 \cdot s$$
$$\frac{33}{4} = \frac{4s}{4}$$
$$s = 8.25$$
The length of each side is 8.25 in.

35. Strategy To find the length, substitute 30 for P in the formula below and solve for s.

Solution
$$P = 4s$$
$$30 = 4 \cdot s$$
$$\frac{30}{4} = \frac{4s}{4}$$
$$s = 7.5$$
The length of each edge is 7.5 ft.

Critical Thinking 4.3, page 276

36. $0.\overline{33}x = 7$
$$\frac{1}{3}x = 7$$
$$3 \cdot \frac{1}{3}x = 3 \cdot 7$$
$$x = 21$$
The solution is 21.

37. a. For example, $x - 0.04 = -1$.

b. For example, $-3x = -6.3$.

Section 4.4

Objective A Exercises, pages 283–284

3. Since $6^2 = 36, \sqrt{36} = 6$.

4. Since $1^2 = 1, \sqrt{1} = 1$.

5. Since $3^2 = 9, -\sqrt{9} = -3$.

6. Since $1^2 = 1, -\sqrt{1} = -1$.

7. Since $13^2 = 169, \sqrt{169} = 13$.

8. Since $14^2 = 196, \sqrt{196} = 14$.

9. Since $15^2 = 225, \sqrt{225} = 15$.

10. Since $9^2 = 81, \sqrt{81} = 9$.

11. Since $5^2 = 25, -\sqrt{25} = -5$.

12. Since $8^2 = 64, -\sqrt{64} = -8$.

13. Since $10^2 = 100, -\sqrt{100} = -10$.

14. Since $2^2 = 4, -\sqrt{4} = -2$

15. $\sqrt{8+17} = \sqrt{25}$
$= 5$

16. $\sqrt{40+24} = \sqrt{64}$
$= 8$

17. $\sqrt{49} + \sqrt{9} = 7 + 3$
$= 10$

18. $\sqrt{100} + \sqrt{16} = 10 + 4$
$= 14$

19. $\sqrt{121} - \sqrt{4} = 11 - 2$
$= 9$

20. $\sqrt{144} - \sqrt{25} = 12 - 5$
$= 7$

21. $3\sqrt{81} = 3 \cdot 9$
$= 27$

22. $8\sqrt{36} = 8 \cdot 6$
$= 48$

23. $-2\sqrt{49} = -2 \cdot 7$
$= -14$

24. $-6\sqrt{121} = -6 \cdot 11$
$= -66$

25. $5\sqrt{16}-4=5\cdot4-4$
$=20-4$
$=16$

26. $7\sqrt{64}+9=7\cdot8+9$
$=56+9$
$=65$

27. $3+10\sqrt{1}=3+10\cdot1$
$=3+10$
$=13$

28. $14-3\sqrt{144}=14-3\cdot12$
$=14-36$
$=14+(-36)$
$=-22$

29. $\sqrt{4}-2\sqrt{16}=2-2\cdot4$
$=2-8$
$=2+(-8)$
$=-6$

30. $\sqrt{144}+3\sqrt{9}=12+3\cdot3$
$=12+9$
$=21$

31. $5\sqrt{25}+\sqrt{49}=5\cdot5+7$
$=25+7$
$=32$

32. $20\sqrt{1}-\sqrt{36}=20\cdot1-6$
$=20-6$
$=14$

33. $\sqrt{\frac{1}{100}}=\frac{1}{10}$

34. $\sqrt{\frac{1}{81}}=\frac{1}{9}$

35. $\sqrt{\frac{9}{16}}=\frac{3}{4}$

36. $\sqrt{\frac{25}{49}}=\frac{5}{7}$

37. $\sqrt{\frac{1}{4}}+\sqrt{\frac{1}{64}}=\frac{1}{2}+\frac{1}{8}$
$=\frac{4}{8}+\frac{1}{8}=\frac{5}{8}$

38. $\sqrt{\frac{1}{36}}-\sqrt{\frac{1}{144}}=\frac{1}{6}-\frac{1}{12}$
$=\frac{2}{12}-\frac{1}{12}=\frac{1}{12}$

39. $-4\sqrt{xy}$
$-4\sqrt{3\cdot12}=-4\sqrt{36}$
$=-4\cdot6$
$=-24$

40. $-3\sqrt{xy}$
$-3\sqrt{20\cdot5}=-3\sqrt{100}$
$=-3\cdot10$
$=-30$

41. $8\sqrt{x+y}$
$8\sqrt{19+6}=8\sqrt{25}$
$=8\cdot5$
$=40$

42. $7\sqrt{x+y}$
$7\sqrt{34+15}=7\sqrt{49}$
$=7\cdot7$
$=49$

43. $5+2\sqrt{ab}$
$5+2\sqrt{27\cdot3}=5+2\sqrt{81}$
$=5+2\cdot9$
$=5+18$
$=23$

44. $6\sqrt{ab}-9$
$6\sqrt{2\cdot32}-9=6\sqrt{64}-9$
$=6\cdot8-9$
$=48-9$
$=39$

45. $\sqrt{a^2+b^2}$
$\sqrt{3^2+4^2}=\sqrt{9+16}$
$=\sqrt{25}$
$=5$

46. $\sqrt{c^2-a^2}$
$\sqrt{10^2-6^2}=\sqrt{100-36}$
$=\sqrt{64}$
$=8$

47. $\sqrt{c^2-b^2}$
$\sqrt{13^2-12^2}=\sqrt{169-144}$
$=\sqrt{25}$
$=5$

48. $\sqrt{b^2-4ac}$
$\sqrt{(-4)^2-4(1)(-5)}=\sqrt{16+20}$
$=\sqrt{36}$
$=6$

49. $5+\sqrt{9}=5+3$
$=8$

50. $\sqrt{4}+8=2+8$
$=10$

51. $6-\sqrt{25}=6-5$
$=1$

52. $7-\sqrt{16}=7-4$
$=3$

53. $-4\sqrt{81}=-4\cdot 9$
$=-36$

54. $-3\sqrt{49}=-3\cdot 7$
$=-21$

Objective B Exercises, pages 284–285

55. $\sqrt{3}\approx 1.7321$

56. $\sqrt{7}\approx 2.6458$

57. $\sqrt{10}\approx 3.1623$

58. $\sqrt{19}\approx 4.3589$

59. $2\sqrt{6}\approx 4.8990$

60. $10\sqrt{21}\approx 45.8258$

61. $3\sqrt{14}\approx 11.2250$

62. $6\sqrt{15}\approx 23.2379$

63. $-4\sqrt{2}\approx -5.6569$

64. $-5\sqrt{13}\approx -18.0278$

65. $-8\sqrt{30}\approx -43.8178$

66. $-12\sqrt{53}\approx -87.3613$

67. 23 is between the perfect squares 16 and 25.
$\sqrt{16}=4$ and $\sqrt{25}=5$
$4<\sqrt{23}<5$

68. 47 is between the perfect squares 36 and 49.
$\sqrt{36}=6$ and $\sqrt{49}=7$
$6<\sqrt{47}<7$

69. 29 is between the perfect squares 25 and 36.
$\sqrt{25}=5$ and $\sqrt{36}=6$
$5<\sqrt{29}<6$

70. 71 is between the perfect squares 64 and 81.
$\sqrt{64}=8$ and $\sqrt{81}=9$
$8<\sqrt{71}<9$

71. 62 is between the perfect squares 49 and 64.
$\sqrt{49}=7$ and $\sqrt{64}=8$
$7<\sqrt{62}<8$

72. 103 is between the perfect squares 100 and 121.
$\sqrt{100}=10$ and $\sqrt{121}=11$
$10<\sqrt{103}<11$

73. 130 is between the perfect squares 121 and 144.
$\sqrt{121}=11$ and $\sqrt{144}=12$
$11<\sqrt{130}<12$

74. 95 is between the perfect squares 81 and 100.
$\sqrt{81}=9$ and $\sqrt{100}=10$
$9<\sqrt{95}<10$

75. $\sqrt{8}=\sqrt{4\cdot 2}$
$=\sqrt{4}\cdot\sqrt{2}$
$=2\sqrt{2}$

76. $\sqrt{12}=\sqrt{4\cdot 3}$
$=\sqrt{4}\cdot\sqrt{3}$
$2\sqrt{3}$

77. $\sqrt{45}=\sqrt{9\cdot 5}$
$=\sqrt{9}\cdot\sqrt{5}$
$=3\sqrt{5}$

78. $\sqrt{18}=\sqrt{9\cdot 2}$
$=\sqrt{9}\cdot\sqrt{2}$
$=3\sqrt{2}$

79. $\sqrt{20} = \sqrt{4 \cdot 5}$
$= \sqrt{4} \cdot \sqrt{5}$
$= 2\sqrt{5}$

80. $\sqrt{44} = \sqrt{4 \cdot 11}$
$= \sqrt{4} \cdot \sqrt{11}$
$= 2\sqrt{11}$

81. $\sqrt{27} = \sqrt{9 \cdot 3}$
$= \sqrt{9} \cdot \sqrt{3}$
$= 3\sqrt{3}$

82. $\sqrt{56} = \sqrt{4 \cdot 14}$
$= \sqrt{4} \cdot \sqrt{14}$
$= 2\sqrt{14}$

83. $\sqrt{48} = \sqrt{16 \cdot 3}$
$= \sqrt{16} \cdot \sqrt{3}$
$= 4\sqrt{3}$

84. $\sqrt{28} = \sqrt{4 \cdot 7}$
$= \sqrt{4} \cdot \sqrt{7}$
$= 2\sqrt{7}$

85. $\sqrt{75} = \sqrt{25 \cdot 3}$
$= \sqrt{25} \cdot \sqrt{3}$
$= 5\sqrt{3}$

86. $\sqrt{96} = \sqrt{16 \cdot 6}$
$= \sqrt{16} \cdot \sqrt{6}$
$= 4\sqrt{6}$

87. $\sqrt{63} = \sqrt{9 \cdot 7}$
$= \sqrt{9} \cdot \sqrt{7}$
$= 3\sqrt{7}$

88. $\sqrt{72} = \sqrt{36 \cdot 2}$
$= \sqrt{36} \cdot \sqrt{2}$
$= 6\sqrt{2}$

89. $\sqrt{98} = \sqrt{49 \cdot 2}$
$= \sqrt{49} \cdot \sqrt{2}$
$= 7\sqrt{2}$

90. $\sqrt{108} = \sqrt{36 \cdot 3}$
$= \sqrt{36} \cdot \sqrt{3}$
$= 6\sqrt{3}$

91. $\sqrt{112} = \sqrt{16 \cdot 7}$
$= \sqrt{16} \cdot \sqrt{7}$
$= 4\sqrt{7}$

92. $\sqrt{200} = \sqrt{100 \cdot 2}$
$= \sqrt{100} \cdot \sqrt{2}$
$= 10\sqrt{2}$

93. $\sqrt{175} = \sqrt{25 \cdot 7}$
$= \sqrt{25} \cdot \sqrt{7}$
$= 5\sqrt{7}$

94. $\sqrt{180} = \sqrt{36 \cdot 5}$
$= \sqrt{36} \cdot \sqrt{5}$
$= 6\sqrt{5}$

Objective C Exercises, pages 285–286

95. Strategy: To find the velocity of the tsunami wave, substitute 100 for d in the given formula and solve for v.

Solution:
$v = 3\sqrt{d}$
$v = 3\sqrt{100}$
$v = 3 \cdot 10 = 30$
The tsunami has a velocity of 30 ft per second.

96. Strategy: To find the velocity of the tsunami wave, substitute 144 for d in the given formula and solve for v.

Solution:
$v = 3\sqrt{d}$
$v = 3\sqrt{144}$
$v = 3 \cdot 12 = 36$
The tsunami has a velocity of 36 ft per second.

97. Strategy: To find the time for the object to fall, substitute 144 for d in the given equation and solve for t.

Solution:
$t = \sqrt{\frac{d}{16}}$
$t = \sqrt{\frac{144}{16}}$
$t = \sqrt{9} = 3$
It takes 3 s for the object to fall 144 ft.

98. Strategy To find the time for the object to fall, substitute 64 for d in the given equation and solve for t.

Solution $t=\sqrt{\frac{d}{16}}$

$t=\sqrt{\frac{64}{16}}$

$t=\sqrt{4}=2$

It takes 2 s for the object to fall 64 ft.

99. Strategy To find the distance, substitute 144 for E and 36 for S in the given formula and solve for d.

Solution $d=4{,}000\sqrt{\frac{E}{S}}-4{,}000$

$d=4{,}000\sqrt{\frac{144}{36}}-4{,}000$

$d=4{,}000\sqrt{4}-4{,}000$

$d=4{,}000\cdot 2-4{,}000$

$d=8{,}000-4{,}000$

$d=4{,}000$

The space explorer is 4,000 mi above the surface.

100. Strategy To find the distance, substitute 189 for E and 21 for S in the given formula and solve for d.

Solution $d=4{,}000\sqrt{\frac{E}{S}}-4{,}000$

$d=4{,}000\sqrt{\frac{189}{21}}-4{,}000$

$d=4{,}000\sqrt{9}-4{,}000$

$d=4{,}000\cdot 3-4{,}000$

$d=12{,}000-4{,}000$

$d=8{,}000$

The space explorer is 8,000 mi above the surface.

Critical Thinking 4.4, page 286

101. $\sqrt{4}=2, \sqrt{100}=10$

The whole numbers between 2 and 10 are 3, 4, 5, 6, 7, 8, and 9.

The whole numbers between $\sqrt{4}$ and $\sqrt{100}$ are 3, 4, 5, 6, 7, 8, and 9.

102. **a.** Since $(0.9)^2=0.81, \sqrt{0.81}=0.9$.

b. Since $(0.8)^2=0.64, -\sqrt{0.64}=-0.8$

c. $\sqrt{2\frac{7}{9}}=\sqrt{\frac{25}{9}}$

Since $\left(\frac{5}{3}\right)^2=\frac{25}{9}, \sqrt{\frac{25}{9}}=\frac{5}{3}$.

$\sqrt{2\frac{7}{9}}=\frac{5}{3}$

d. $-\sqrt{3\frac{1}{16}}=-\sqrt{\frac{49}{16}}$

Since $\left(\frac{7}{4}\right)^2=\frac{49}{16}, -\sqrt{\frac{49}{16}}=-\frac{7}{4}$.

$-\sqrt{3\frac{1}{16}}=-\frac{7}{4}$

103. $\sqrt{\frac{1}{4}+\frac{1}{8}}=\sqrt{\frac{2}{8}+\frac{1}{8}}=\sqrt{\frac{3}{8}}\approx 0.61237$

$\sqrt{\frac{1}{3}+\frac{1}{9}}=\sqrt{\frac{3}{9}+\frac{1}{9}}=\sqrt{\frac{4}{9}}=\frac{2}{3}\approx 0.66667$

$\sqrt{\frac{1}{5}+\frac{1}{6}}=\sqrt{\frac{6}{30}+\frac{5}{30}}=\sqrt{\frac{11}{30}}\approx 0.60553$

$\sqrt{\frac{1}{5}+\frac{1}{6}}<\sqrt{\frac{1}{4}+\frac{1}{8}}<\sqrt{\frac{1}{3}+\frac{1}{9}}$

104. **a.** $\sqrt{16+9}\neq\sqrt{16}+\sqrt{9}$

$\sqrt{25}\neq 4+3$

$5\neq 7$

b. $\sqrt{16-9}\neq\sqrt{16}-\sqrt{9}$

$\sqrt{7}\neq 4-3$

$\sqrt{7}\neq 1$, Since $\sqrt{7}\approx 2.6458$

105. **a.** Since $36=6^2$, 36 is a perfect square. 36 has 9 factors (1, 2, 3, 4, 6, 9, 12, 18, 36).

The number 36 is a two-digit perfect square that has exactly nine factors.

b. 14 and 4 have a difference of 10 ($14-4=10$).

4, the smaller number, is a perfect square $\left(2^2=4\right)$.

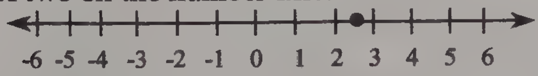
14, the larger number, is 2 less than a perfect square ($14+2=16$, and $4^2=16$).

The numbers are 14 and 4.

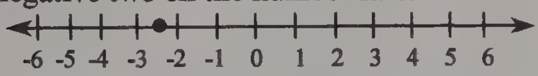
Section 4.5

Objective A Exercises, pages 293–294

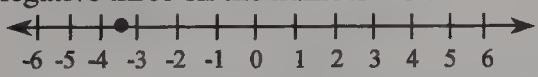
1. Draw a solid dot one half unit to the right of two on the number line.



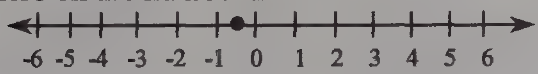
2. Draw a solid dot one half unit to the left of negative two on the number line.



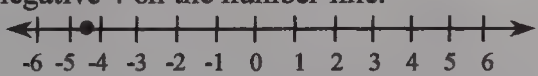
3. Draw solid dot one half unit to the left of negative three on the number line.



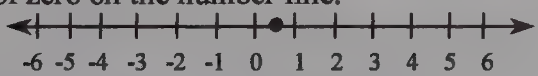
4. Draw a solid dot one half unit to the left of zero on the number line



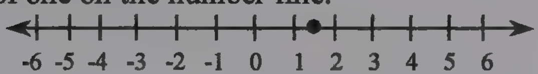
5. Draw a solid dot one half unit to the left of negative 4 on the number line.



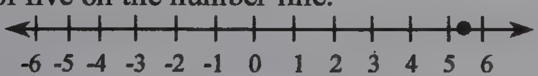
6. Draw a solid dot one half unit to the right of zero on the number line.



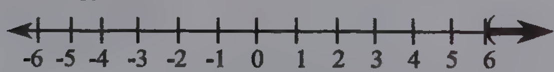
7. Draw a solid dot one half unit to the right of one on the number line.



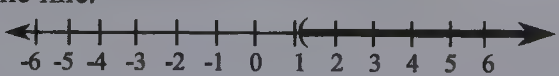
8. Draw a solid dot one half unit to the right of five on the number line.



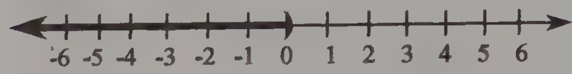
9. The real numbers greater than 6 are to the right of 6 on the number line. Draw a parenthesis at 6. Draw a heavy line to the right of 6. Draw an arrow at the right of the line.



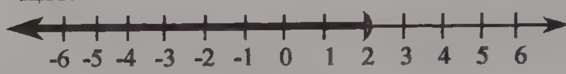
10. The real numbers greater than 1 are to the right of 1 on the number line. Draw a parenthesis at 1. Draw a heavy line to the right of 1. Draw an arrow at the right of the line.



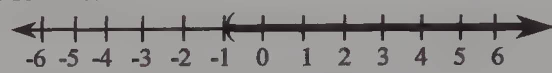
11. The real numbers less than 0 are to the left of 0 on the number line. Draw a parenthesis at 0. Draw a heavy line to the left of 0. Draw an arrow at the left of the line.



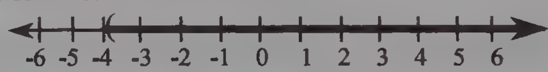
12. The real numbers less than 2 are to the left of 2 on the number line. Draw a parenthesis at 2. Draw a heavy line to the left of 2. Draw an arrow at the left of the line.



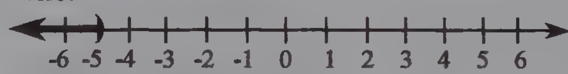
13. The real numbers greater than –1 are to the right of –1 on the number line. Draw a parenthesis at –1. Draw a heavy line to the right of –1. Draw an arrow at the right of the line.



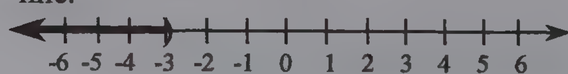
14. The real numbers greater than –4 are to the right of –4 on the number line. Draw a parenthesis at –4. Draw a heavy line to the right of –4. Draw an arrow at the right of the line.



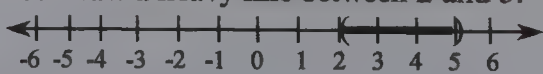
15. The real numbers less than –5 are to the left of –5 on the number line. Draw a parenthesis at –5. Draw a heavy line to the left of –5. Draw an arrow at the left of the line.



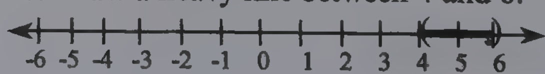
16. The real numbers less than –3 are to the left of –3 on the number line. Draw a parenthesis at –3. Draw a heavy line to the left of –3. Draw an arrow at the left of the line.



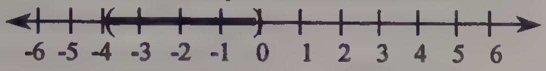
17. Draw a parenthesis at 2 and a parenthesis at 5. Draw a heavy line between 2 and 5.



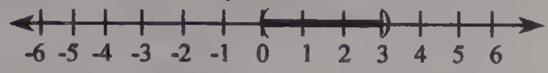
18. Draw a parenthesis at 4 and a parenthesis at 6. Draw a heavy line between 4 and 6.



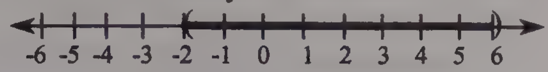
19. Draw a parenthesis at –4 and a parenthesis at 0. Draw a heavy line between –4 and 0.



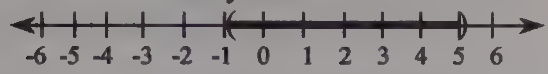
20. Draw a parenthesis at 0 and a parenthesis at 3. Draw a heavy line between 0 and 3.



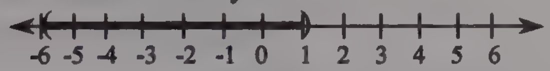
21. Draw a parenthesis at –2 and a parenthesis at 6. Draw a heavy line between –2 and 6.



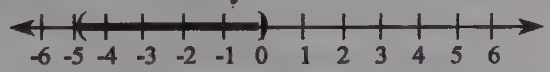
22. Draw a parenthesis at –1 and a parenthesis at 5. Draw a heavy line between –1 and 5.



23. Draw a parenthesis at –6 and a parenthesis at 1. Draw a heavy line between –6 and 1.



24. Draw a parenthesis at –5 and a parenthesis at 0. Draw a heavy line between –5 and 0.



Objective B Exercises, pages 294–295

25. a. $x > 9$
$-3.8 > 9$ False

b. $x > 9$
$0 > 9$ False

c. $x > 9$
$9 > 9$ False

d. $x > 9$
$\sqrt{101} > 9$ True
The number $\sqrt{101}$ makes the inequality true.

26. a. $x \le 5$
$-\sqrt{11} \le 5$ True

b. $x \le 5$
$0 \le 5$ True

c. $x \le 5$
$5 \le 5$ True

d. $x \le 5$
$5.01 \le 5$ False
The numbers $-\sqrt{11}$, 0, and 5 make the inequality true.

27. a. $x \ge -2$
$-6 \ge 2$ False

b. $x \ge -2$
$-2 \ge -2$ True

c. $x \ge -2$
$0.4 \ge -2$ True

d. $x \ge -2$
$\sqrt{17} \ge -2$ True
The numbers –2, 0.4, and $\sqrt{17}$ make the inequality true.

28. a. $x \le -7$
$-14 \le -7$ True

b. $x \le -7$
$-7 \le -7$ True

c. $x \le -7$
$-1.3 \le -7$ False

d. $x \le -7$
$-\sqrt{2} \le -7$ False
The numbers –14 and –7 make the inequality true.

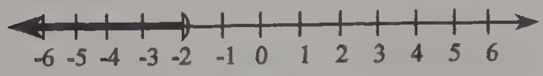
29. All real numbers less than 3 make the inequality true.

30. All real numbers greater than –6 make the inequality true.

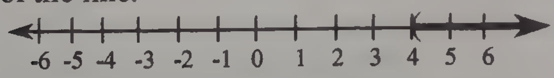
31. All real numbers greater than or equal to –1 make the inequality true.

32. All real numbers less than or equal to 5 make the inequality true.

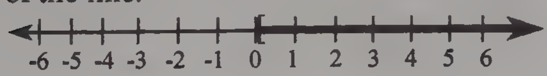
33. Draw a parenthesis at –2. Draw a heavy line to the left of –2. Draw an arrow at the left of the line.



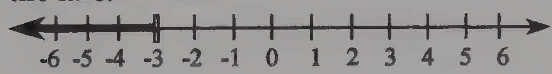
34. Draw a parenthesis at 4. Draw a heavy line to the right of 4. Draw an arrow at the right of the line.



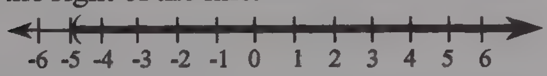
35. Draw a bracket at 0. Draw a heavy line to the right of 0. Draw an arrow at the right of the line.



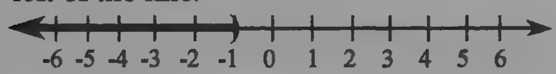
36. Draw a bracket at –3. Draw a heavy line to the left of –3. Draw an arrow at the left of the line.



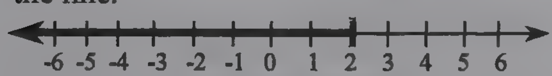
37. Draw a parenthesis at –5. Draw a heavy line to the right of –5. Draw an arrow at the right of the line.



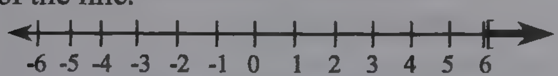
38. Draw a parenthesis at –1. Draw a heavy line to the left of –1. Draw an arrow at the left of the line.



39. Draw a bracket at 2. Draw a heavy line to the left of 2. Draw an arrow at the left of the line.



40. Draw a bracket at 6. Draw a heavy line to the right of 6. Draw an arrow at the right of the line.



Objective C Exercises, pages 295–296

41. Strategy
→To write the inequality, let s represent the number of sales. Since it is a minimum goal, the sales must be greater or equal to 50,000.
→To determine if the sales goal has been reached, replace s in the inequality by 49,000. If the inequality is true, the sales quota has been reached. If the inequality is false, the sales quota has not been reached.

Solution
$s \geq 50{,}000$
$49{,}000 \geq 50{,}000$ False
The sales representative has not met the minimum quota for sales.

42. Strategy
→To write the inequality, let c represent the cholesterol level. Since the cholesterol level is a maximum, all levels should be less than 220.
→To determine if a cholesterol level is within the recommended levels, replace c in the inequality by 238. If the inequality is true, the cholesterol level is within acceptable limits. If the inequality is false, the cholesterol level is not within acceptable limits.

Solution
$c < 220$
$238 < 200$ False
The cholesterol level is above the recommended maximum level.

43. Strategy

→To write the inequality, let h represent the number of credit hours allows per semester. Since h is a maximum, a part-time student carries credit hours that are less than or equal to 9.

→To determine if a student taking 8.5 credit hours is a part-time student, replace h in the inequality by 8.5 If the inequality is true the student is part-time. If the inequality is false, the student is a full-time student.

Solution

$h \le 9$

$8.5 \le 9$ True

The student is a part-time student.

44. Strategy

→To write the inequality, let w represent the weight of the aluminum cans. Since the bonus is given for a minimum amount, it is collected if w is greater than 1,750.

→To determine if the service organization receives the bonus, replace w in the inequality by 1,705.5. If the inequality is true the organization receives the bonus. If false, the bonus is not earned.

Solution

$w > 1{,}750$

$1{,}705.5 > 1{,}750$ False

The service organization does not earn the bonus.

45. Strategy

→To write the inequality, let b represent the monthly budget. Since the budget is a maximum, b is less than or equal to 1,200.

→To determine if the budget has been exceeded, replace b in the inequality by 1,190.50. If the inequality is true, the budget has not been exceeded. If the inequality is false, the monthly budget has been exceeded.

Solution

$b \le 1{,}200$

$1190.50 \le 1{,}200$ True

The monthly budget has not been exceeded.

46. Strategy

→To write the inequality, let p represent the points earned. Since the score is a minimum, let p be greater than 80.

→To determine if the score is high enough to earn a B, substitute $80\frac{1}{2}$ in the inequality. If the inequality is true, then you will earn a B in the course. If the inequality is false, you will not earn a B.

Solution

$p > 80$

$80\frac{1}{2} > 80$ True

You will receive a B in the history course.

47. Strategy →To write the inequality, let T represent the temperature. Since the temperature is a minimum, T is greater than 50.
→To determine if the computer disks are safely stored, replace T in the inequality by 47.5. If the inequality is true, the temperature is in the safe range. If the inequality is false, the temperature is not suitable for storing computer disks.

Solution $T > 50$
$47.5 > 50$ False
The computer disks are not safely stored at 47.5°F.

48. Strategy →To write the inequality, let d represent the diameter of the ring on a basketball hoop. Since the diameter of the ring is a maximum, the diameter must be less than or equal to $\frac{5}{8}$.
→To determine if the ring meets NCAA regulations, replace d in the inequality by $\frac{9}{16}$. If the inequality is true, the ring meets NCAA regulations. If the inequality if false, the ring does not meet NCAA regulations.

Solution $d \le \frac{5}{8}$
$\frac{9}{16} \le \frac{5}{8}$
$\frac{9}{16} \le \frac{10}{16}$ True
The ring on the basketball hoop meets NCAA regulations.

Critical Thinking 4.5, page 296

49. **a.** –2 is an integer, a negative integer, a rational number, and a real number.
b. 18 is a whole number, an integer, a positive integer, a rational number, and a real number.
c. $-\frac{9}{37}$ is a rational number and a real number.
d. –6.606 is a rational number and a real number.
e. $4.\overline{56}$ is a rational number and a real number.
f. 3.050050005 … is an irrational number and a real number.

50. **a.** The graph is the real numbers greater than –2.
$x > -2$
b. The graph is the real numbers less than or equal to –1.
$x \le -1$

51. a.

$\lvert x\rvert < 9$	$\lvert x\rvert < 9$	$\lvert x\rvert < 9$	$\lvert x\rvert < 9$
$\lvert -2.5\rvert < 9$	$\lvert 0\rvert < 9$	$\lvert 9\rvert < 9$	$\lvert 15.8\rvert < 9$
$2.5 < 9$	$0 < 9$	$9 < 9$	$15.8 < 9$
True	True	False	False

The numbers –2.5 and 0 make the inequality $\lvert x\rvert < 9$ true.

b.

$\lvert x\rvert > -3$	$\lvert x\rvert > -3$	$\lvert x\rvert > -3$	$\lvert x\rvert > -3$
$\lvert -6.3\rvert > -3$	$\lvert -3\rvert > -3$	$\lvert 0\rvert > -3$	$\lvert 6.7\rvert > -3$
$6.3 > -3$	$3 > -3$	$0 > -3$	$6.7 > -3$
True	True	True	True

The numbers –6.3, –3, 0, and 6.7 make the inequality $\lvert x\rvert > -3$ true.

c.

$\lvert x\rvert \ge 4$	$\lvert x\rvert \ge 4$	$\lvert x\rvert \ge 4$	$\lvert x\rvert \ge 4$
$\lvert -1.5\rvert \ge 4$	$\lvert 0\rvert \ge 4$	$\lvert 4\rvert \ge 4$	$\lvert 13.6\rvert \ge 4$
$1.5 \ge 4$	$0 \ge 4$	$4 \ge 4$	$13.6 \ge 4$
False	False	True	True

The numbers 4 and 13.6 make the inequality $\lvert x\rvert \ge 4$ true.

d.

$\lvert x\rvert \le 5$	$\lvert x\rvert \le 5$	$\lvert x\rvert \le 5$	$\lvert x\rvert \le 5$
$\lvert -4.9\rvert \le 5$	$\lvert 0\rvert \le 5$	$\lvert 2.1\rvert \le 5$	$\lvert 5\rvert \le 5$
$4.9 \le 5$	$0 \le 5$	$2.1 \le 5$	$5 \le 5$
True	True	True	True

The numbers –4.9, 0, 2.1 and 5 make the inequality $\lvert x\rvert \le 5$ true.

52. The answer is a. For example:

a. $1 + 2 < 3 + 4$
$3 < 7$
True

b. $3 + 4 < 1 + 2$
$7 < 3$
False

c. $1 + 4 < 3 + 2$
$5 < 5$
False

d. $3 + 2 < 1 + 4$
$5 < 5$
False

53. a. $a > 0$ means a is a positive number.
$b > 0$ means b is a positive number.
ab is the product of a and b.
The product of two positive numbers is a positive number.
$ab > 0$ means the product of a and b is a positive number.
The statement is always true.

b. $a < 0$ means a is a negative number.
$a^2 > 0$ means that the square of the negative number a is a positive number.
The square of any negative number is a positive number.
The statement is always true.

c. $a > 0$ and $b > 0$ means that both a and b are positive numbers.
$a^2 > b$ means that the square of a is greater than b.
If $a = 5$ and $b = 2$, then $a^2 = 5^2 = 25$ and $a^2 > 2$.
If $a = 2$ and $b = 5$, then $a^2 = 2^2 = 4$ and a^2 is not greater than 5.
The statement is sometimes true.

Chapter Review Exercises, pages 301–302

1. $3\sqrt{47} \approx 20.5670$

2. $0.918 \cdot 10^5 = 91,800$

3. $-\sqrt{121} = -11$

4. $-3.981 - 4.32 = -3.981 + (-4.32)$
$= -8.301$

5. $a + b + c$
$80.59 + (-3.647) + 12.3$
$= 76.943 + 12.3$
$= 89.243$

6. 5.034

7. $\sqrt{100} - 2\sqrt{49} = 10 - 2 \cdot 7$
$= 10 - 14$
$= 10 + (-14)$
$= -4$

8. $14.2 \div 10^3 = 0.0142$

9. $4.2z = -1.428$
$\dfrac{4.2z}{4.2} = \dfrac{-1.428}{4.2}$
$z = -0.34$
The solution is -0.34.

10. $8.31 = 8.310$
$8.039 < 8.310$
$8.039 < 8.31$

11. $\dfrac{x}{y}$
$\dfrac{0.396}{3.6} = 0.11$

12.
$$\begin{array}{r} 9.47 \\ \times 0.26 \\ \hline 5682 \\ 1\,894 \\ \hline 2.4622 \end{array}$$

13. a. $x \geq -1$
$-6 \geq -1$
False

b. $x \geq -1$
$-1 \geq -1$
True

c. $x \geq -1$
$-0.5 \geq -1$
True

d. $x \geq -1$
$\sqrt{10} \geq -1$
True

The numbers -1, -0.5, and $\sqrt{10}$ make the inequality true.

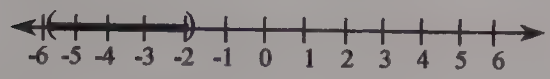
14. $\frac{3}{7} \approx 0.4286$ $\qquad 0.429 = 0.4290$
$0.4286 < 0.4290$
$\frac{3}{7} < 0.429$

15. $0.28 = \frac{28}{100} = \frac{7}{25}$

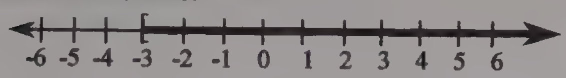
16. $-6.8 \div 47.92 \approx -0.1$

17. $38.5 - 28.8 = 9.7$
Employees in the wholesale trade industry worked 9.7 h per week more than those in retail trade industry.

18. Draw a parenthesis at –6 and a parenthesis at –2. Draw a heavy line between –6 and –2.



19. Draw a bracket at –3. Draw a heavy line to the right of –3. Draw an arrow at the right end of the line.



20. $-247.8 + (-193.4) = -441.2$

21. $614.3 \div 100 = 6.143$

22. $a - b$
$80.32 - 29.577 = 80.32 + (-29.577)$
$= 50.743$

23. $\sqrt{90} = \sqrt{9 \cdot 10}$
$= \sqrt{9} \cdot \sqrt{10}$
$= 3\sqrt{10}$

24. $60st$
$60(5)(-3.7) = 300(-3.7)$
$= -1{,}110$

25.
$$\begin{array}{rcr} 506.81 & \rightarrow & 500 \\ 64.1 & \rightarrow & \underline{60} \\ & & 440 \end{array}$$

26. Strategy
→To write the inequality, let G represent the grade point average. Since it is a minimum qualification to qualify for a scholarship, the grade point average must be greater than or equal to 3.5
→To determine if the grade point average qualifies the student for a scholarship, replace G by 3.48. If the inequality is true, the student qualifies. If the inequality is false, the student does not qualify for the scholarship.

Solution
$G \geq 3.5$
$3.48 \geq 3.5$ False
The student does not qualify for the scholarship.

27. Strategy
To find the difference, subtract the melting point of mercury (–38.87) from the boiling point of mercury (356.58).

Solution
$356.58 - (-38.87)$
$= 356.58 + 38.87$
$= 395.45$
The difference in temperature between the melting and boiling point of mercury is 395.45°C.

28. Strategy
a. To find the difference, subtract the cost of World War I (0.38) from the cost of World War II (3.1).

b. To find how many times greater the monetary cost of the Vietnam War was, divide the cost of the Vietnam War by the cost of World War I.

Solution
a. $3.1 - 0.38 = 2.72$
The difference between the monetary costs of the two World Wars was \$2.72 trillion.

b. $0.57 \div 0.38 = 1.5$
The cost of the Vietnam War was 1.5 times the cost of World War I.

29. Strategy To find the cost per ounce, divide 5.89 by 7.

Solution $\frac{5.89}{7} \approx 0.8414$

To the nearest cent, the cost of instant coffee is \$.84 per ounce.

30. Strategy To find the monthly lease payment, write and solve an equation using x to represent the monthly lease payment.

Solution

the total of the monthly payments	is	the product of the number of months of the lease and the monthly lease payment

$4{,}988.88 = 24x$

$\frac{4{,}988.88}{24} = \frac{24x}{24}$

$207.87 = x$

The monthly lease payment is \$207.87.

31. Strategy To find the price of the treadmill, substitute 369.99 for C and 129.50 for M in the given formula and solve for P.

Solution $P = C + M$

$P = 369.99 + 129.50$

$P = 499.49$

The price of the treadmill is \$499.49.

32. Strategy To find the velocity of the falling object, substitute 25 for d in the given formula and solve for v.

Solution $v = \sqrt{64d}$

$v = \sqrt{64 \cdot 25}$

$v = \sqrt{1{,}600}$

$v = 40$

The velocity of the falling object is 40 feet per second.

Chapter Test, pages 303–304

1. 9.033

2. $4.003 < 4.009$

3. 6.051367 *Given place value*

$3 < 5$

6.051367 rounded to the nearest thousandth is 6.051.

4. $-30 - (-7.249) = -30 + 7.247$
$= -22.753$

5. $x - y$
$6.379 - (-8.28) = 6.379 + 8.28$
$= 14.659$

6.
$$\begin{array}{rcr} 92.34 & \rightarrow & 90 \\ -17.95 & \rightarrow & -20 \\ \hline 74.39 & & 70 \end{array}$$

7. $4.58 - 3.9 + 6.017$
$= 4.58 + (-3.9) + 6.017$
$= 0.68 + 6.017$
$= 66.97$

8. $-2.5(7.36) = -18.4$

9. $-20cd$
$-20 \cdot 0.5 \cdot (-6.4) = (-10) \cdot (-6.4)$
$= 64$

10. $5.488 = -3.92p$
$\frac{5.488}{-3.92} = \frac{-3.92p}{-3.92}$
$p = -1.4$

11. $\sqrt{256} - 2\sqrt{121} = 16 - 2 \cdot 11$
$= 16 - 22$
$= 16 + (-22)$
$= -6$

12. $84.96 \div 100 = 0.8496$

13. $\frac{x}{y}$

$\frac{52.7}{-6.2} = -8.5$

14. $0.22 = 0.2200 \qquad \frac{2}{9} \approx 0.2222$

$0.2200 < 0.2222$

$0.22 < \frac{2}{9}$

15. $2\sqrt{46} \approx 13.5647$

16. $\sqrt{68} = \sqrt{4 \cdot 17}$

$= \sqrt{4} \cdot \sqrt{17}$

$= 2\sqrt{17}$

17. $63.6 - 22.8 = 40.8$
The gross from *Thunderball* was \$40.8 million more than from *On Her Majesty's Secret Service*.

18. $8.4 = 5.9 + a$

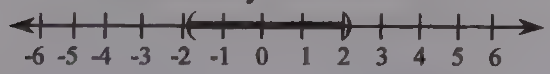
$8.4 \mid 5.9 + (-2.5)$

$8.4 \neq 3.4$

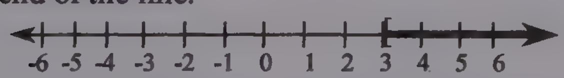
No, –2.5 is not a solution of the equation.

19. $8.973 \cdot 10^4 = 89{,}730$

20. Draw a parenthesis at –2 and a parenthesis at 2. Draw a heavy line between –2 and 2.



21. Draw a bracket at 3. Draw a heavy line to the right of 3. Draw an arrow at the right end of the line.



22. $x + y$
$-233.81 + 71.3 = -162.51$

23. $-8v = 26$

$\frac{-8v}{-8} = \frac{26}{-8}$

$p = -3.25$

24. Strategy: To find the difference, subtract the melting point of fluorine (–219.62) from the boiling point of fluorine (–188.14).

Solution: $-188.14 - (-219.62)$
$= -188.14 + 219.62 = 31.5$
The difference in temperature between the melting and boiling point of fluorine is 31.5°C.

25. Strategy: To find the velocity of the falling object, substitute 16 for *d* in the given formula and solve for *v*.

Solution: $v = \sqrt{64d}$

$v = \sqrt{64 \cdot 16}$

$v = \sqrt{1{,}024}$

$v = 32$

The velocity of the falling object is 32 feet per second.

26. Strategy: To find the stockholders' equity, substitute 48.2 for *A* and 27.6 for *L* in the given formula and solve for *S*.

Solution: $A = L + S$
$48.2 = 27.6 + S$
$48.2 - 27.6 = 27.6 - 27.6 + S$
$20.6 = S$
The stockholders' equity is \$20.6 million.

27. Strategy: To find the perimeter, substitute 8.75, 5.25, and 4.5 for *a*, *b*, and *c* in the formula below and solve for *P*.

Solution: $P = a + b + c$
$P = 8.75 + 5.25 + 4.5 = 18.5$
The perimeter is 18.5 m.

28. Strategy →To write the inequality, let x represent the units sold. Since it is a minimum to reach the goal, the sales must be greater or equal to 65,000 per year.
→To determine if the number of units sold has reached the goal, replace x by 57,000. If the inequality is true, the goal has been reached. If the inequality is false, the representative has not reached the sales goal.

Solution $x \geq 65{,}000$
$57{,}000 \geq 65{,}000$ False
The representative has not reached the sales goal.

29. Strategy To find the force on the falling object, substitute 5.75 for m and –9.80 for g in the given formula and solve for F.

Solution $F = ma$
$F = 5.75(-9.80)$
$F = -56.35$
The force on the object is –56.35 newtons.

30. Strategy To find the temperature fall, subtract the low temperature (–20.56) from the temperature 15 minutes later (2.78).

Solution $2.78 - (-20.56) = 2.78 + 20.56$
$= 23.34$
The temperature rose 23.34°C in 15 minutes.

Cumulative Review Exercises, pages 305–306

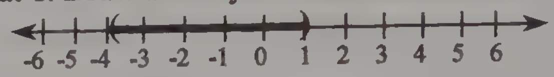
1. $387.9 \div 10^4 = 0.03879$

2. $(x+y)^2 - 2z$
$(-3+2)^2 - 2(-5) = (-1)^2 - 2(-5)$
$= 1 - 2(-5)$
$= 1 - (-10)$
$= 1 + 10 = 11$

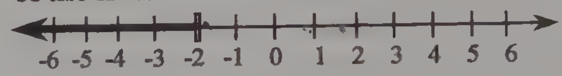
3. $-9.8 = -0.49c$
$\frac{-9.8}{-0.49} = \frac{-0.49c}{-0.49}$
$20 = c$
The solution is 20.

4. 8,072,092

5. Draw a parenthesis at –4 and a parenthesis at 1. Draw a heavy line between –4 and 1.



6. Draw a bracket at –2. Draw a heavy line to the left of –2. Draw an arrow at the left end of the line.



7. $-23 - (-19) = -23 + 19$
$= -4$

8.
$$\begin{array}{rcr} 372 & \rightarrow & 400 \\ 541 & \rightarrow & 500 \\ 608 & \rightarrow & 600 \\ 429 & \rightarrow & +\ 400 \\ \hline & & 1{,}900 \end{array}$$

9. $\sqrt{192} = \sqrt{64 \cdot 3}$
$= \sqrt{64} \cdot \sqrt{3}$
$= 8\sqrt{3}$

10. $x \div y$
$3\frac{2}{3} \div 2\frac{4}{9} = \frac{11}{3} \div \frac{22}{9}$
$= \frac{11}{3} \cdot \frac{9}{22}$
$= \frac{11 \cdot 9}{3 \cdot 22}$
$= \frac{11 \cdot 3 \cdot 3}{3 \cdot 2 \cdot 11}$
$= \frac{3}{2} = 1\frac{1}{2}$

11. $-36.92 + 18.5 = -18.42$

12. $\left(\frac{5}{9}\right)\left(-\frac{3}{10}\right)\left(-\frac{6}{7}\right) = \left(\frac{5}{9} \cdot \frac{3}{10} \cdot \frac{6}{7}\right)$
$= \frac{5 \cdot 3 \cdot 6}{9 \cdot 10 \cdot 7}$
$= \frac{5 \cdot 3 \cdot 2 \cdot 3}{3 \cdot 3 \cdot 2 \cdot 5 \cdot 7}$
$= \frac{1}{7}$

13. x^4y^2

$2^4 \cdot 10^2 = (2\cdot 2\cdot 2\cdot 2)\cdot(10\cdot 10)$
$= 16 \cdot 100$
$= 1{,}600$

14. $5\overline{)65}$ with quotient 13

$2\overline{)130}$

$2\overline{)260}$

$260 = 2\cdot 2\cdot 5\cdot 13 = 2^2\cdot 5\cdot 13$

15. $25\overline{)19.00}$ with quotient 0.76

$\frac{19}{25} = 0.76$

16. $10\sqrt{19} \approx 95.3939$

17. **a.** $32 > 28$
Sweden mandates more vacation days than Ireland.

b. $30 \div 20 = 1.5$
Austria mandates 1.5 times more vacation days than Switzerland.

18. $\frac{-8}{0}$

Division by zero is undefined.

19. $-\frac{5}{7} + \frac{4}{21} = \frac{-5}{7} + \frac{4}{21}$

$= \frac{-15}{21} + \frac{4}{21}$

$= \frac{-15+4}{21}$

$= \frac{-11}{21} = -\frac{11}{21}$

20. $4\sqrt{25} - \sqrt{81} = 4\cdot 5 - 9$
$= 20 - 9$
$= 11$

21. $62.8 \rightarrow 60$
$0.47 \rightarrow \times 0.5$
30

22. $5(3-7) \div (-4) + 6(2)$
$= 5(-4) \div (-4) + 6(2)$
$= -20 \div (-4) + 6(2)$
$= 5 + 6(2)$
$= 5 + 12$
$= 17$

23. $\frac{a}{b+c}$

$\frac{\frac{3}{8}}{\frac{1}{2}+\frac{3}{4}} = \frac{\frac{3}{8}}{\frac{5}{4}}$

$= \frac{3}{8} \div \frac{5}{4}$

$= \frac{3}{8}\cdot\frac{4}{5}$

$= \frac{3\cdot 4}{8\cdot 5}$

$= \frac{3\cdot 2\cdot 2}{2\cdot 2\cdot 2\cdot 5} = \frac{3}{10}$

24. $x - y + z$

$\frac{5}{12} - \left(-\frac{3}{8}\right) + \left(-\frac{3}{4}\right) = \frac{5}{12} + \frac{3}{8} + \frac{-3}{4}$

$= \frac{10}{24} + \frac{9}{24} + \frac{-18}{24}$

$= \frac{10+9+(-18)}{24}$

$= \frac{1}{24}$

25. $2.617 \div 0.93 \approx 2.8$

26. Strategy To calculate the cellular phone service bill:
→Calculate the number of minutes the service was used after the first 20 min.
→Add the monthly charge (19.99) to the product of 0.75 and the number of minutes the service was used after the first 20 min.

Solution $37 - 20 = 17$
The service was used for 17 min after the first 20 min.
$0.75(17) + 19.99 = 12.75 + 19.99 = 32.74$
The cellular phone service bill is \$32.74.

27. Strategy To find the temperature fall, subtract the temperature at midnight (–29.4) from the temperature at noon (17.22).

Solution $17.22 - (-29.4) = 17.22 + 29.4 = 46.62$
The temperature fell 46.62°C in the 12-hour period.

28. Strategy To find the cost per visit, substitute 195 for M and 125 for N in the given formula and solve for C.

Solution $C = \frac{M}{N}$

$C = \frac{195}{125}$

$C = 1.56$

The cost per visit is $1.56.

29. Strategy

a. To find the number of hours worked per week, add the number of hours spent in all five categories.

b. To determine which takes more time, compare the amount of time spent on face-to-face selling (13.9) with the sum of the time spent on administrative work (7.0) and placing service calls (5.6).

Solution

a. $13.9 + 11.5 + 8.5 + 7.0 + 5.6 = 46.5$

On average, a salesperson works 46.5 h per week.

b. $7.0 + 5.6 = 12.6$

$13.9 > 12.6$

The average salesperson spends more time on face-to-face selling.

30. Strategy To find the velocity, substitute 45 for d in the given equation and solve for v.

Solution $v = \sqrt{20d}$

$v = \sqrt{20 \cdot 45}$

$v = \sqrt{900}$

$v = 30$

The velocity of the car is 30 mph.

Chapter 5

Section 5.1

Objective A Exercises, pages 315–317

1. The Associative Property of Multiplication
2. The Addition Property of Zero
3. The Commutative Property of Addition
4. The Commutative Property of Multiplication
5. The Inverse Property of Addition
6. The Commutative Property of Addition
7. The Inverse Property of Multiplication
8. The Inverse Property of Addition
9. The Commutative Property of Multiplication
10. The Multiplication Property of One
11. a. The Associative Property of Multiplication

    b. The Inverse Property of Multiplication

    c. The Multiplication Property of One
12. a. The Associative Property of Addition

    b. The Inverse Property of Addition

    c. The Addition Property of Zero
13. $x + (4 + y) = (x + 4) + y$
14. $v \cdot w = w \cdot v$
15. $5 \cdot \frac{1}{5} = 1$
16. $\frac{4}{3} \cdot \frac{3}{4} = 1$
17. $a \cdot 0 = 0$
18. $a \cdot \frac{1}{a} = 1$
19. $-7y + 7y = 0$
20. $\frac{2}{3}x + \left(-\frac{2}{3}x\right) = 0$
21. $-\frac{3}{2}$
22. $-\frac{a}{2}$
23. $\begin{aligned}6(2x) &= (6 \cdot 2)x \\ &= 12x\end{aligned}$
24. $\begin{aligned}3(4y) &= (3 \cdot 4)y \\ &= 12y\end{aligned}$
25. $\begin{aligned}-5(3x) &= (-5 \cdot 3)x \\ &= -15x\end{aligned}$
26. $\begin{aligned}-3(6z) &= (-3 \cdot 6)z \\ &= -18z\end{aligned}$
27. $\begin{aligned}(3t) \cdot 7 &= 7 \cdot (3t) \\ &= (7 \cdot 3)t \\ &= 21t\end{aligned}$
28. $\begin{aligned}(9r) \cdot 5 &= 5 \cdot (9r) \\ &= (5 \cdot 9)r \\ &= 45r\end{aligned}$
29. $\begin{aligned}(-3p) \cdot 7 &= 7 \cdot (-3p) \\ &= [7 \cdot (-3)]p \\ &= -21p\end{aligned}$
30. $\begin{aligned}(-4w) \cdot 6 &= 6 \cdot (-4w) \\ &= [6 \cdot (-4)]w \\ &= -24w\end{aligned}$
31. $\begin{aligned}(-2)(-6q) &= [(-2)(-6)]q \\ &= 12q\end{aligned}$
32. $\begin{aligned}(-3)(-5m) &= [(-3)(-5)]m \\ &= 15m\end{aligned}$
33. $\begin{aligned}\frac{1}{2}(4x) &= \left(\frac{1}{2} \cdot 4\right)x \\ &= 2x\end{aligned}$
34. $\begin{aligned}\frac{2}{3}(6n) &= \left(\frac{2}{3} \cdot 6\right)n \\ &= 4n\end{aligned}$
35. $\begin{aligned}-\frac{5}{3}(9w) &= \left(-\frac{5}{3} \cdot 9\right)w \\ &= -15w\end{aligned}$

36. $-\frac{2}{5}(10v) = \left(-\frac{2}{5}\cdot 10\right)v$
$= -4v$

37. $-\frac{1}{2}(-2x) = \left[\left(-\frac{1}{2}\right)(-2)\right]x$
$= 1 \cdot x = x$

38. $-\frac{1}{3}(-3x) = \left[\left(-\frac{1}{3}\right)(-3)\right]x$
$= 1 \cdot x = x$

39. $(2x)(3x) = (2 \cdot 3)(x \cdot x)$
$= 6x^2$

40. $(4k)(6k) = (4 \cdot 6)(k \cdot k)$
$= 24k^2$

41. $(-3x)(9x) = (-3 \cdot 9)(x \cdot x)$
$= -27x^2$

42. $(4b)(-12b) = [4 \cdot (-12)](b \cdot b)$
$= -48b^2$

43. $\left(\frac{1}{2}x\right)(2x) = \left(\frac{1}{2}\cdot 2\right)(x \cdot x)$
$= 1 \cdot x^2 = x^2$

44. $\left(\frac{1}{3}h\right)(3h) = \left(\frac{1}{3}\cdot 3\right)(h \cdot h)$
$= 1 \cdot h^2 = h^2$

45. $\left(-\frac{2}{3}\right)(x)\left(-\frac{3}{2}\right) = \left[\left(-\frac{2}{3}\right)\left(-\frac{3}{2}\right)\right]x$
$= 1 \cdot x = x$

46. $\left(-\frac{4}{3}\right)(z)\left(-\frac{3}{4}\right) = \left[\left(-\frac{4}{3}\right)\left(-\frac{3}{4}\right)\right]z$
$= 1 \cdot z = z$

47. $6\left(\frac{1}{6}c\right) = \left(6 \cdot \frac{1}{6}\right)c$
$= 1 \cdot c = c$

48. $9\left(\frac{1}{9}v\right) = \left(9 \cdot \frac{1}{9}\right)v$
$= 1 \cdot v = v$

49. $-5\left(-\frac{1}{5}a\right) = \left(-5 \cdot -\frac{1}{5}\right)a$
$= 1 \cdot a = a$

50. $-9\left(-\frac{1}{9}s\right) = \left(-9 \cdot -\frac{1}{9}\right)s$
$= 1 \cdot s = s$

51. $\frac{4}{5}w \cdot 15 = \left(\frac{4}{5}\cdot 15\right)w$
$= 12w$

52. $\frac{7}{5}y \cdot 30 = \left(\frac{7}{5}\cdot 30\right)y$
$= 42y$

53. $2v \cdot 8w = (2 \cdot 8)(v \cdot w)$
$= 16vw$

54. $3m \cdot 7n = (3 \cdot 7)(m \cdot n)$
$= 21mn$

55. $(-4b)(7c) = (-4 \cdot 7)(b \cdot c)$
$= -28bc$

56. $(-3k)(-6m) = [(-3)(-6)](k \cdot m)$
$= 18km$

57. $3x + (-3x) = 0$

58. $7xy + (-7xy) = 0$

59. $-12h + 12h = 0$

60. $5 + 8y + (-8y) = 5 + 0$
$= 5$

61. $9 + 2m + (-2m) = 9 + 0$
$= 9$

62. $12 - 3m + 3m = 12 + 0$
$= 12$

63. $8x + 7 + (-8x) = 8x + (-8x) + 7$
$= 0 + 7$
$= 7$

64. $13v + 12 + (-13v) = 12 + 13v + (-13v)$
$= 12 + 0$
$= 12$

65. $6t - 15 + (-6t) = -15 + 6t + (-6t)$
$= -15 + 0$
$= -15$

66. $10z - 4 + (-10z) = -4 + 10z + (-10z)$
$= -4 + 0$
$= -4$

67. $8 + (-8) - 5y = 0 - 5y$
$= -5y$

68. $12 + (-12) - 7b = 0 - 7b$
$= -7b$

69. $(-4) + 4 + 13b = 0 + 13b$
$= 13b$

70. $-7 + 7 - 15t = 0 - 15t$
$= -15t$

Objective B Exercises, pages 317–318

71. $2(5z + 2) = 2(5z) + 2(2)$
$= 10z + 4$

72. $3(4n + 5) = 3(4n) + 3(5)$
$= 12n + 15$

73. $6(2y + 5z) = 6(2y) + 6(5z)$
$= 12y + 30z$

74. $4(7a + 2b) = 4(7a) + 4(2b)$
$= 28a + 8b$

75. $3(7x - 9) = 3(7x) - 3(9)$
$= 21x - 27$

76. $9(3w - 7) = 9(3w) - 9(7)$
$= 27w - 63$

77. $-(2x - 7) = -2x + 7$

78. $-(3x + 4) = -3x - 4$

79. $-(-4x - 9) = 4x + 9$

80. $-(-5y - 12) = 5y + 12$

81. $-5(y + 3) = -5(y) + (-5)(3)$
$= -5y - 15$

82. $-4(x + 5) = -4(x) + (-4)(5)$
$= -4x - 20$

83. $-6(2x - 3) = -6(2x) - (-6)(3)$
$= -12x + 18$

84. $-3(7y - 4) = -3(7y) - (-3)(4)$
$= -21y + 12$

85. $-5(4n - 8) = -5(4n) - (-5)(8)$
$= -20n + 40$

86. $-4(3c - 2) = -4(3c) - (-4)(2)$
$= -12c + 8$

87. $-8(-6z + 3) = -8(-6z) + (-8)(3)$
$= 48z - 24$

88. $-2(-3k + 9) = -2(-3k) + (-2)(9)$
$= 6k - 18$

89. $-6(-4p - 7) = -6(-4p) - (-6)(7)$
$= 24p + 42$

90. $-5(-8c - 5) = -5(-8c) - (-5)(5)$
$= 40c + 25$

91. $5(2a + 3b + 1) = 5(2a) + 5(3b) + 5(1)$
$= 10a + 15b + 5$

92. $5(3x + 9y + 8) = 5(3x) + 5(9y) + 5(8)$
$= 15x + 45y + 40$

93. $4(3x - y - 1) = 4(3x) - 4(y) - 4(1)$
$= 12x - 4y - 4$

94. $3(2x - 3y + 7) = 3(2x) - 3(3y) + 3(7)$
$= 6x - 9y + 21$

95. $9(4m - n + 2) = 9(4m) - 9(n) + 9(2)$
$= 36m - 9n + 18$

96. $-4(3x + 2y - 5)$
$= -4(3x) + (-4)(2y) - (-4)(5)$
$= -12x - 8y + 20$

97. $-6(-2v + 3w + 7)$
$= -6(-2v) + (-6)(3w) + (-6)(7)$
$= 12v - 18w - 42$

98. $-7(-2b - 4) = -7(-2b) - (-7)(4)$
$= 14b + 28$

99. $-4(-5x - 1) = -4(-5x) - (-4)(1)$
$= 20x + 4$

100. $-9(3x - 6y) = -9(3x) - (-9)(6y)$
$= -27x + 54y$

101. $5(4a - 5b + c) = 5(4a) - 5(5b) + 5(c)$
$= 20a - 25b + 5c$

102. $-4(-2m - n + 3)$
$= -4(-2m) - (-4)(n) + (-4)(3)$
$= 8m + 4n - 12$

103. $-6(3p - 2r - 9)$
$= -6(3p) - (-6)(2r) - (-6)(9)$
$= -18p + 12r + 54$

104. $-(4x + 6y - 8z) = -4x - 6y + 8z$

105. $-(5a - 9b + 7) = -5a + 9b - 7$

106. $-(-6m + 3n + 1) = 6m - 3n - 1$

107. $-(11p - 2q - r) = -11p + 2q + r$

Critical Thinking 5.1, page 318

108. a. False. $4 \div 2 = 2$ and $2 \div 4 = \frac{1}{2}$. Therefore $4 \div 2 \neq 2 \div 4$.

b. False. $(8 \div 4) \div 2 = 2 \div 2 = 1$ and $8 \div (4 \div 2) = 8 \div 2 = 4$. Therefore $(8 \div 4) \div 2 \neq 8 \div (4 \div 2)$.

c. False. $(8 - 4) - 2 = 4 - 2 = 2$ and $8 - (4 - 2) = 8 - 2 = 6$. Therefore $(8 - 4) - 2 \neq 8 - (4 - 2)$.

d. False. $8 - 4 = 4$ and $4 - 8 = -4$. Therefore $8 - 4 \neq 4 - 8$.

109. No. The statement is not true for the number zero.

110. Yes.

111. No. The number zero does not have a multiplicative inverse.

Section 5.2

Objective A Exercises, pages 323–324

1. $3x^2, 4x, \underline{-9}$

2. $-7y^2, -2y, \underline{6}$

3. $b, \underline{5}$

4. $8n^2, \underline{-1}$

5. $9\underline{a^2}, -12\underline{a}, 4\underline{b^2}$

6. $6\underline{x^2y}, 7\underline{xy^2}$

7. $3\underline{x^2}$

8. $-2\underline{n^2}, 5\underline{n}$

9. coefficient of x^2: 1
coefficient of $-6x$: -6

10. coefficient of $-x$: -1

11. coefficient of $12a^2$: 12
coefficient of $4ab$: 4

12. coefficient of x^2y: 1
coefficient of $-x$: -1
coefficient of y: 1

13. $7a + 9a = 16a$

14. $8c + 15c = 23c$

15. $12x + 15x = 27x$

16. $9b + 24b = 33b$

17. $9z - 6z = 3z$

18. $12h - 4h = 8h$

19. $9x - x = 8x$

20. $12y - y = 11y$

21. $8z - 15z = -7z$

22. $2p - 13p = -11p$

23. $w - 7w = -6w$

24. $y - 9y = -8y$

25. $12v - 12v = 0$

26. $11c - 11c = 0$

27. $9s - 8s = s$

28. $6n - 5n = n$

29. $4x - 3y + 2x = 4x + 2x - 3y$
$= 6x - 3y$

30. $3m - 6n + 4m = 3m + 4m - 6n$
$= 7m - 6n$

31. $4r + 8p - 2r + 5p$
$= 4r - 2r + 8p + 5p$
$= 2r + 13p$

32. $-12t - 6s + 9t + 4s$
$= -12t + 9t - 6s + 4s$
$= -3t - 2s$

33. $9w - 5v - 12w + 7v$
$= 9w - 12w - 5v + 7v$
$= -3w + 2v$

34. $3c - 8 + 7c - 9 = 3c + 7c - 8 - 9$
$= 10c - 17$

35. $-4p+9-5p+2=-4p-5p+9+2$
$=-9p+11$

36. $-6y-17+4y+9=-6y+4y-17+9$
$=-2y-8$

37. $8p+7-6p-7=8p-6p+7-7$
$=2p+0$
$=2p$

38. $9m-12+2m+12$
$=9m+2m-12+12$
$=11m+0$
$=11m$

39. $7h+15-7h-9=7h-7h+15-9$
$=0+6$
$=6$

40. $7v^2-9v+v^2-8v=7v^2+v^2-9v-8v$
$=8v^2-17v$

41. $9y^2-8+4y^2+9=9y^2+4y^2-8+9$
$=13y^2+1$

42. $r^2+4r-8r-5r^2=r^2-5r^2+4r-8r$
$=-4r^2-4r$

43. $3w^2-7-9+9w^2=3w^2+9w^2-7-9$
$=12w^2-16$

44. $4c-7c^2+8c-8c^2$
$=-7c^2-8c^2+4c+8c$
$=-15c^2+12c$

45. $9w^2-15w+w-9w^2$
$=9w^2-9w^2-15w+w$
$=0-14w$
$=-14w$

46. $12v^2+15v-14v-12v^2$
$=12v^2-12v^2+15v-14v$
$=0+v$
$=v$

47. $7a^2b+5ab^2-2a^2b+3ab^2$
$=7a^2b-2a^2b+5ab^2+3ab^2$
$=5a^2b+8ab^2$

48. $3xy^2+2x^2y-7xy^2-4x^2y$
$=3xy^2-7xy^2+2x^2y-4x^2y$
$=-4xy^2-2x^2y$

49. $8a-9b+2-8a+9b+3$
$=8a-8a-9b+9b+2+3$
$=0+0+5$
$=5$

50. $10v+12w-9-v-12w+9$
$=10v-v+12w-12w-9+9$
$=9v+0+0$
$=9v$

51. $6x^2-7x+1+5x^2+5x-1$
$=6x^2+5x^2-7x+5x+1-1$
$=11x^2-2x+0$
$=11x^2-2x$

52. $4y^2+7y+1+y^2-10y+9$
$=4y^2+y^2+7y-10y+1+9$
$=5y^2-3y+10$

53. $-3b^2+6b+1+11b^2-8b-1$
$=-3b^2+11b^2+6b-8b+1-1$
$=8b^2-2b+0$
$=8b^2-2b$

54. $-4z^2-6z+1-z^2+7z+8$
$=-4z^2-z^2-6z+7z+1+8$
$=-5z^2+z+9$

Objective B Exercises, pages 324–326

55. $5x+2(x+1)=5x+2x+2$
$=7x+2$

56. $6y+2(2y+3)=6y+4y+6$
$=10y+6$

57. $9n-3(2n-1)=9n-6n+3$
$=3n+3$

58. $12x-2(4x-6)=12x-8x+12$
$=4x+12$

59. $7a-(3a-4)=7a-3a+4$
$=4a+4$

60. $9m-4(2m-3)=9m-8m+12$
$=m+12$

61. $7 + 2(2a - 3) = 7 + 4a - 6$
$= 4a + 1$

62. $5 + 3(2y - 8) = 5 + 6y - 24$
$= 6y - 19$

63. $6 + 4(2x + 9) = 6 + 8x + 36$
$= 8x + 42$

64. $4 + 3(7d + 7) = 4 + 21d + 21$
$= 21d + 25$

65. $8 - 4(3x - 5) = 8 - 12x + 20$
$= -12x + 28$

66. $13 - 7(4y + 3) = 13 - 28y - 21$
$= -28y - 8$

67. $2 - 9(2m + 6) = 2 - 18m - 54$
$= -18m - 52$

68. $4 - 7(6w - 9) = 4 - 42w + 63$
$= -42w + 67$

69. $3(6c + 5) + 2(c + 4)$
$= 18c + 15 + 2c + 8$
$= 20c + 23$

70. $7(2k - 5) + 3(4k - 3)$
$= 14k - 35 + 12k - 9$
$= 26k - 44$

71. $2(a - 2b) + 3(2a + 3b)$
$= 2a - 4b + 6a + 9b$
$= 8a + 5b$

72. $4(3x - 6y) + 5(2x - 3y)$
$= 12x - 24y + 10x - 15y$
$= 22x - 39y$

73. $6(7z - 5) - 3(9z - 6)$
$= 42z - 30 - 27z + 18$
$= 15z - 12$

74. $8(2t + 4) - 4(3t - 1)$
$= 16t + 32 - 12t + 4$
$= 4t + 36$

75. $-2(6y + 2) + 3(4y - 5)$
$= -12y - 4 + 12y - 15$
$= -19$

76. $-3(2a - 5) - 2(4a + 3)$
$= -6a + 15 - 8a - 6$
$= -14a + 9$

77. $-5(x - 2y) - 4(2x + 3y)$
$= -5x + 10y - 8x - 12y$
$= -13x - 2y$

78. $-6(-x - 3y) - 2(-3x + 9y)$
$= 6x + 18y + 6x - 18y$
$= 12x$

79. $2 - 3(2v - 1) + 2(2v + 4)$
$= 2 - 6v + 3 + 4v + 8$
$= -2v + 13$

80. $5 - 2(3x + 5) - 3(4x - 1)$
$= 5 - 6x - 10 - 12x + 3$
$= -18x - 2$

81. $2c - 3(c + 4) - 2(2c - 3)$
$= 2c - 3c - 12 - 4c + 6$
$= -5c - 6$

82. $5m - 2(3m + 2) - 4(m - 1)$
$= 5m - 6m - 4 - 4m + 4$
$= -5m$

83. $8a + 3(2a - 1) + 6(4 - 2a)$
$= 8a + 6a - 3 + 24 - 12a$
$= 2a + 21$

84. $9z - 2(2z - 7) + 4(3 - 5z)$
$= 9z - 4z + 14 + 12 - 20z$
$= -15z + 26$

85. $3n - 2[5 - 2(2n - 4)]$
$= 3n - 2[5 - 4n + 8]$
$= 3n - 2[13 - 4n]$
$= 3n - 26 + 8n$
$= 11n - 26$

86. $6w + 4[3 - 5(6w - 2)]$
$= 6w + 4[3 - 30w + 10]$
$= 6w + 4[-30w + 13]$
$= 6w - 120w + 52$
$= -114w + 52$

87. $9x - 3[8 - 2(5 - 3x)]$
$= 9x - 3[8 - 10 + 6x]$
$= 9x - 3[-2 + 6x]$
$= 9x + 6 - 18x$
$= -9x + 6$

88. $11y - 7[2(2y - 5) + 3(7 - 5y)]$
$= 11y - 7[4y - 10 + 21 - 15y]$
$= 11y - 7[-11y + 11]$
$= 11y + 77y - 77$
$= 88y - 77$

89. $-3v-6[2(3-2v)-5(3v-7)]=-3v-6[6-4v-15v+35]$
$=-3v-6[-19v+41]$
$=-3v+114v-246$
$=111v-246$

90. $8b-3[2(3-5b)-4(3b-4)]=8b-3[6-10b-12b+16]$
$=8b-3[-22b+22]$
$=8b+66b-66$
$=74b-66$

91. $21r-4[3(4-5r)-3(2-7r)]=21r-4[12-15r-6+21r]$
$=21r-4[6+6r]$
$=21r-24-24r$
$=-3r-24$

92. $7y^2-2\left[3(2y-4)+3\left(2y^2\right)\right]=7y^2-2\left[6y-12+6y^2\right]$
$=7y^2-12y+24-12y^2$
$=-5y^2-12y+24$

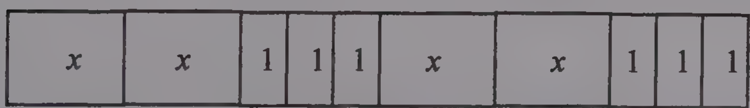
93. $9z^2-3\left[4(2z+3)-3\left(2z^2-6\right)\right]=9z^2-3\left[8z+12-6z^2+18\right]$
$=9z^2-3\left[-6z^2+8z+30\right]$
$=9z^2+18z^2-24z-90$
$=27z^2-24z-90$

Critical Thinking 5.2, page 326

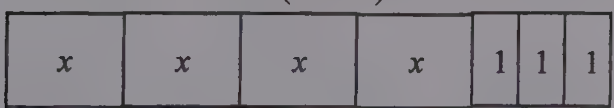
94.

$2+3x$

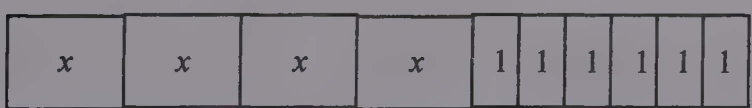
$5x$



$2(2x+3)$



$4x+3$



$4x+6$

The figure represented by $2(2x+3)$ is equivalent to the figure represented by $4x+6$. This is an illustration of The Distributive Property by using a diagram.
The figure $2+3x$ is not equivalent to $5x$. This illustrates the property that unlike terms cannot be combined.

95. $6\cdot527=6(500+20+7)=6\cdot500+6\cdot20+6\cdot7=3{,}000+120+42=3{,}162$

Section 5.3

Objective A Exercises, page 329

2. $(5y^2+3y-7)+(6y^2-7y+9)=(5y^2+6y^2)+(3y-7y)+(-7+9)$
$=11y^2-4y+2$

3. $(-8x^2-11x-15)+(4x^2-12x+13)=(-8x^2+4x^2)+(-11x-12x)+(-15+13)$
$=-4x^2-23x-2$

4. $(4x^2-6x+7)+(5x^2+x-9)=(4x^2+5x^2)+(-6x+x)+(7+-9)$
$=9x^2-5x-2$

5. $(-2x^2+4x-11)+(x^2-8x+1)=(-2x^2+x^2)+(4x-8x)+(-11+1)$
$=-x^2-4x-10$

6. $(3w^3+8w^2-2w)+(5w^2-6w-5)=3w^3+(8w^2+5w^2)+(-2w-6w)-5$
$=3w^3+13w^2-8w-5$

7. $(11p^3-9p^2-6p)+(10p^2-8p+4)=11p^3+(-9p^2+10p^2)+(-6p-8p)+4$
$=11p^3+p^2-14p+4$

8. $(-9a^3+3a^2+2a-7)+(7a^3-12a^2-10a+8)$
$=(-9a^3+7a^3)+(3a^2-12a^2)+(2a-10a)+(-7+8)$
$=-2a^3-9a^2-8a+1$

9. $(7x^3-8x^2+9x-12)+(-3x^3-7x^2+5x-9)$
$=(7x^3-3x^3)+(-8x^2-7x^2)+(9x+5x)+(-12-9)$
$=4x^3-15x^2+14x-21$

10. $$\begin{array}{r} 5k^2-7k-8 \\ 6k^2+9k-10 \\ \hline 11k^2+2k-18 \end{array}$$

11. $$\begin{array}{r} 8v^2-9v+12 \\ 12v^2-11v-2 \\ \hline 20v^2-20v+10 \end{array}$$

12. $$\begin{array}{rrrr} 8x^3 & -9x^2 & & +2 \\ 9x^3 & & +9x & -7 \\ \hline 17x^3 & -9x^2 & +9x & -5 \end{array}$$

13. $$\begin{array}{rrrr} 13z^3 & -7z^2 & +4z & \\ & 10z^2 & +5z & -9 \\ \hline 13z^3 & +3z^2 & +9z & -9 \end{array}$$

14. $$\begin{array}{r} 12b^3+9b^2+5b-10 \\ \underline{4b^3+5b^2-5b+11} \\ 16b^3+14b^2\qquad+1 \end{array}$$

15. $$\begin{array}{r} 5a^3-a^2+4a-19 \\ \underline{-a^3+a^2-7a+19} \\ 4a^3\qquad-3a\quad \end{array}$$

16. $$\begin{array}{r} 6t^2-8t-15 \\ \underline{7t^2+8t-20} \\ 13t^2\qquad-35 \end{array}$$

17. $$\begin{array}{r} 8y^2-3y-1 \\ \underline{-6y^2+3y-1} \\ 2y^2\qquad-2 \end{array}$$

Objective B Exercises, pages 329–330

19. $(3x^2-2x-5)-(x^2+7x-3)=(3x^2-2x-5)+(-x^2-7x+3)$
$=2x^2-9x-2$

20. $(7y^2-8y-10)-(3y^2+2y-9)=(7y^2-8y-10)+(-3y^2-2y+9)$
$=4y^2-10y-1$

21. $(5b^2-2b+3)-(4b^2+6b-1)=(5b^2-2b+3)+(-4b^2-6b+1)$
$=b^2-8b+4$

22. $(6x^2-4x-12)-(x^2+5x+4)=(6x^2-4x-12)+(-x^2-5x-4)$
$=5x^2-9x-16$

23. $(11b^3-2b^2+1)-(6b^2-12b-13)=(11b^3-2b^2+1)+(-6b^2+12b+13)$
$=11b^3-8b^2+12b+14$

24. $(13w^3+3w^2-9)-(7w^3-9w+10)=(13w^3+3w^2-9)+(-7w^3+9w-10)$
$=6w^3+3w^2+9w-19$

25. $(8z^3-9z^2+4z+12)-(10z^3-z^2+4z-9)=(8z^3-9z^2+4z+12)+(-10z^3+z^2-4z+9)$
$=-2z^3-8z^2+21$

26. $(15t^3-9t^2+8t+11)-(17t^3-9t^2-8t+6)=(15t^3-9t^2+8t+11)+(-17t^3+9t^2+8t-6)$
$=-2t^3+16t+5$

27. $(-6r^3+9r^2+19)-(6r^3-16r+19)=(-6r^3+9r^2+19)+(-6r^3+16r-19)$
$=-12r^3+9r^2+16r$

28. $(-4v^3+8v-2)-(6v^3-13v^2+7v+1)=(-4v^3+8v-2)+(-6v^3+13v^2-7v-1)$
$=-10v^3+13v^2+v-3$

29.
$$\begin{array}{r} 4a^2 + 9a - 11 \\ \underline{-2a^2 + 3a + 9} \\ 2a^2 + 12a - 2 \end{array}$$

30.
$$\begin{array}{r} 8b^2 - 7b - 6 \\ \underline{-5b^2 - 8b - 12} \\ 3b^2 - 15b - 18 \end{array}$$

31.
$$\begin{array}{r} 6z^3 + 4z^2 \qquad + 1 \\ \underline{-3z^3 \qquad + 8z + 9} \\ 3z^3 + 4z^2 + 8z + 10 \end{array}$$

32.
$$\begin{array}{r} 10y^3 \qquad - 8y - 13 \\ \underline{-6y^2 - 2y - 7} \\ 10y^3 - 6y^2 - 10y - 20 \end{array}$$

33.
$$\begin{array}{r} 10b^3 \qquad -7b \qquad \\ \underline{-8b^2 \qquad -14} \\ 10b^3 - 8b^2 - 7b - 14 \end{array}$$

34.
$$\begin{array}{r} 7m - 6 \\ \underline{-2m + 1} \\ 5m - 5 \end{array}$$

35.
$$\begin{array}{r} 5n^3 + 8n^2 - 4n - 9 \\ \underline{-2n^3 - 8n^2 - 4n + 9} \\ 3n^3 \qquad -8n \end{array}$$

36.
$$\begin{array}{r} 4q^3 + 7q^2 + 8q - 9 \\ \underline{-14q^3 - 7q^2 + 8q + 9} \\ -10q^3 \qquad + 16q \end{array}$$

37.
$$\begin{array}{r} 10b^2 - 7b + 4 \\ \underline{-8b^2 - 5b + 14} \\ 2b^2 - 12b + 18 \end{array}$$

38.
$$\begin{array}{r} 7m^2 - 3m - 6 \\ \underline{-2m^2 + m - 5} \\ 5m^2 - 2m - 11 \end{array}$$

Critical Thinking 5.3, page 330

39. Strategy: To find the perimeter, substitute $(2x^2 + 4x - 3)$ for L and $(x^2 + x + 5)$ for W in the formula below and solve for P.

Solution:
$P = 2L + 2W$
$P = 2 \cdot (2x^2 + 4x - 3) + 2 \cdot (x^2 + x + 5)$
$= 4x^2 + 8x - 6 + 2x^2 + 2x + 10$
$= 6x^2 + 10x + 4$
The perimeter is $(6x^2 + 10x + 4)$ km.

40. Strategy: To find the perimeter, substitute $(3b^2 - b - 6)$ for L and $(b^2 + 3b + 8)$ for W in the formula below and solve for P.

Solution:
$P = 2L + 2W$
$P = 2 \cdot (3b^2 - b - 6) + 2 \cdot (b^2 + 3b + 8)$
$= 6b^2 - 2b - 12 + 2b^2 + 6b + 16$
$= 8b^2 + 4b + 4$
The perimeter is $(8b^2 + 4b + 4)$ m.

41. Strategy: To find the perimeter, substitute $(y + 1)$ for a and $(y + 2)$ for b and $(y + 8)$ for c in the formula below and solve for P.

Solution:
$P = a + b + c$
$P = (y + 1) + (y + 2) + (y + 8)$
$= 3y + 11$
The perimeter is $(3y + 11)$ ft.

42. **a.** The degree of the monomial $2a^2b^6$ is $2 + 6 = 8$.

b. The degree of the monomial $-5xy^5z^3$ is $1 + 5 + 3 = 9$.

c. The degree of the monomial $9mn^2p$ is $1 + 2 + 1 = 4$.

Section 5.4

Objective A Exercises, page 335

1. $a^4 \cdot a^5 = a^9$

2. $y^5 \cdot y^8 = y^{13}$

3. $x^9 \cdot x^7 = x^{16}$

4. $d^6 \cdot d = d^7$

5. $n^4 \cdot n^2 = n^6$

6. $p^7 \cdot p^3 = p^{10}$

7. $z^3 \cdot z \cdot z^4 = z^8$

8. $b \cdot b^2 \cdot b^6 = b^9$

9. $(a^3b^2)(a^5b) = (a^3 \cdot a^5)(b^2 \cdot b)$
$= a^8b^3$

10. $(xy^5)(x^3y^7) = (x \cdot x^3)(y^5 \cdot y^7)$
$= x^4y^{12}$

11. $(-m^3n)(m^6n^2) = -(m^3 \cdot m^6)(n \cdot n^2)$
$= -m^9n^3$

12. $(-r^4t^3)(r^2t^9) = -(r^4 \cdot r^2)(t^3 \cdot t^9)$
$= -r^6t^{12}$

13. $(2x^3)(5x^4) = (2 \cdot 5)(x^3 \cdot x^4)$
$= 10x^7$

14. $(6x^3)(9x) = (6 \cdot 9)(x^3 \cdot x)$
$= 54x^4$

15. $(8x^2y)(xy^5) = 8(x^2 \cdot x)(y \cdot y^5)$
$= 8x^3y^6$

16. $(4a^3b^4)(3ab^5) = (4 \cdot 3)(a^3 \cdot a)(b^4 \cdot b^5)$
$= 12a^4b^9$

17. $(-4m^3)(3m^4) = (-4 \cdot 3)(m^3 \cdot m^4)$
$= -12m^7$

18. $(6r^2)(-4r) = [6 \cdot (-4)](r^2 \cdot r)$
$= -24r^3$

19. $(7v^3)(-2w) = [7 \cdot (-2)](v^3)w$
$= -14v^3w$

20. $(-9a^3)(4b^2) = [(-9) \cdot 4]a^3 \cdot b^2$
$= -36a^3b^2$

21. $(ab^2c^3)(-2b^3c^2)$
$= -2 \cdot a(b^2 \cdot b^3)(c^3 \cdot c^2)$
$= -2ab^5c^5$

22. $(4x^2y^3)(-5x^5) = [4 \cdot (-5)](x^2 \cdot x^5)y^3$
$= -20x^7y^3$

23. $(4b^4c^2)(6a^3b) = (4 \cdot 6)(a^3)(b^4 \cdot b)(c^2)$
$= 24a^3b^5c^2$

24. $(3xy^5)(5y^2z) = (3 \cdot 5)(x)(y^5 \cdot y^2)(z)$
$= 15xy^7z$

25. $(-8r^2t^3)(-5rt^4v)$
$= [(-8)(-5)](r^2 \cdot r)(t^3 \cdot t^4)(v)$
$= 40r^3t^7v$

26. $(-4ab^3c^2)(b^3c) = -4(a)(b^3 \cdot b^3)(c^2 \cdot c)$
$= -4ab^6c^3$

27. $(9mn^4p)(-3mp^2)$
$= [9 \cdot (-3)](m \cdot m)(n^4)(p \cdot p^2)$
$= -27m^2n^4p^3$

28. $(-3v^2wz)(-4vz^4)$
$= [(-3)(-4)](v^2 \cdot v)(w)(z \cdot z^4)$
$= 12v^3wz^5$

29. $(2x)(3x^2)(4x^4) = (2 \cdot 3 \cdot 4)(x \cdot x^2 \cdot x^4)$
$= 24x^7$

30. $(5a^2)(4a)(3a^5) = (5\cdot 4\cdot 3)(a^2\cdot a\cdot a^5)$
$= 60a^8$

31. $(3ab)(2a^2b^3)(a^3b)$
$= (3\cdot 2)(a\cdot a^2\cdot a^3)(b\cdot b^3\cdot b)$
$= 6a^6b^5$

32. $(4x^2y)(3xy^5)(2x^2y^2)$
$= (4\cdot 3\cdot 2)(x^2\cdot x\cdot x^2)(y\cdot y^5\cdot y^2)$
$= 24x^5y^8$

33. $(-xy^5)(3x^2)(5y^3)$
$= -(3\cdot 5)(x\cdot x^2)(y^5\cdot y^3)$
$= -15x^3y^8$

34. $(-6m^3n)(-mn^2)(m)$
$= [(-6)(-1)](m^3\cdot m\cdot m)(n\cdot n^2)$
$= 6m^5n^3$

35. $(8rt^3)(-2r^3v^2)(-3t^5v^2)$
$= [8\cdot(-2)(-3)](r\cdot r^3)(t^3\cdot t^5)(v^2\cdot v^2)$
$= 48r^4t^8v^4$

36. $(-y^5z)(-2x^3z)(-3xy^4)$
$= [(-1)(-2)(-3)](x^3\cdot x)(y^5\cdot y^4)(z\cdot z)$
$= -6x^4y^9z^2$

37. $(-5ac^3)(-4b^3c)(-3a^2b^2)$
$= [(-5)(-4)(-3)](a\cdot a^2)(b^3\cdot b^2)(c^3\cdot c)$
$= -60a^3b^5c^4$

38. $(7x^2y^3z^5)(3xy^4)$
$= (7\cdot 3)(x^2\cdot x)(y^3\cdot y^4)z^5$
$= 21x^3y^7z^5$

39. $(2ab^6)(-4a^5b^4)$
$= [2(-4)](a\cdot a^5)(b^6\cdot b^4)$
$= -8a^6b^{10}$

Objective B Exercises, page 336

40. $(x^3)^5 = x^{3\cdot 5}$
$= x^{15}$

41. $(b^2)^4 = b^{2\cdot 4}$
$= b^8$

42. $(z^6)^3 = z^{6\cdot 3}$
$= z^{18}$

43. $(p^4)^7 = p^{4\cdot 7}$
$= p^{28}$

44. $(y^{10})^2 = y^{10\cdot 2}$
$= y^{20}$

45. $(c^7)^4 = c^{7\cdot 4}$
$= c^{28}$

46. $(d^9)^2 = d^{9\cdot 2}$
$= d^{18}$

47. $(3x)^2 = 3^{1\cdot 2}x^{1\cdot 2}$
$= 3^2x^2 = 9x^2$

48. $(2y)^3 = 2^{1\cdot 3}y^{1\cdot 3}$
$= 2^3y^3 = 8y^3$

49. $(x^2y^3)^6 = x^{2\cdot 6}y^{3\cdot 6}$
$= x^{12}y^{18}$

50. $(m^4n^2)^3 = m^{4\cdot 3}n^{2\cdot 3}$
$= m^{12}n^6$

51. $(r^3t)^4 = r^{3\cdot 4}t^{1\cdot 4}$
$= r^{12}t^4$

52. $(a^2b)^5 = a^{2\cdot 5}b^{1\cdot 5}$
$= a^{10}b^5$

53. $\left(-y^2\right)^2 = (-1)^{1\cdot 2} y^{2\cdot 2}$
$= y^4$

54. $\left(-z^3\right)^2 = (-1)^{1\cdot 2} z^{3\cdot 2}$
$= z^6$

55. $\left(2x^4\right)^3 = 2^{1\cdot 3} x^{4\cdot 3}$
$= 2^3 x^{12}$
$= 8x^{12}$

56. $\left(3n^3\right)^3 = 3^{1\cdot 3} n^{3\cdot 3}$
$= 3^3 n^9$
$= 27n^9$

57. $\left(-2a^2\right)^3 = (-2)^{1\cdot 3} a^{2\cdot 3}$
$= (-2)^3 a^6$
$= -8a^6$

58. $\left(-3b^3\right)^2 = (-3)^{1\cdot 2} b^{3\cdot 2}$
$= (-3)^2 b^6$
$= 9b^6$

59. $\left(3x^2y\right)^2 = 3^{1\cdot 2} x^{2\cdot 2} y^{1\cdot 2}$
$= 3^2 x^4 y^2$
$= 9x^4y^2$

60. $\left(4a^4b^5\right)^3 = 4^{1\cdot 3} a^{4\cdot 3} b^{5\cdot 3}$
$= 4^3 a^{12} b^{15}$
$= 64a^{12}b^{15}$

61. $\left(2a^3bc^2\right)^3 = 2^{1\cdot 3} a^{3\cdot 3} b^{1\cdot 3} c^{2\cdot 3}$
$= 2^3 a^9 b^3 c^6$
$= 8a^9b^3c^6$

62. $\left(4xy^3z^2\right)^2 = 4^{1\cdot 2} x^{1\cdot 2} y^{3\cdot 2} z^{2\cdot 2}$
$= 4^2 x^2 y^6 z^4$
$= 16x^2y^6z^4$

63. $\left(-mn^5p^3\right)^4$
$= (-1)^{1\cdot 4} m^{1\cdot 4} n^{5\cdot 4} p^{3\cdot 4}$
$= m^4 n^{20} p^{12}$

Critical Thinking 5.4, page 324

64. Strategy To find the area, substitute $(6x^2)$ for L and $(2x)$ for W in the formula below and solve for A.

Solution $A = LW$
$A = 6x^2 \cdot 2x$
$= 12x^3$
The area is $(12x^3)$ m^2.

65. Strategy To find the area, substitute $(3a^2b^5)$ for L and (a^4b) for W in the formula below and solve for A.

Solution $A = LW$
$A = 3a^2b^5 \cdot a^4b$
$= 3a^6b^6$
The area is $(3a^6b^6)$ ft^2.

66. Strategy To find the area, substitute $(7y^5)$ for s in the formula below and solve for A.

Solution $A = s^2$
$A = \left(7y^5\right)^2 = 7^2 \cdot y^{5\cdot 2}$
$= 49y^{10}$
The area is $(49y^{10})$ cm^2.

67. $\left(2^3\right)^2 = 2^6 = 64$
$2^{\left(3^2\right)} = 2^9 = 512$

The results are not the same. $2^{\left(2^3\right)}$ is the larger number.

Section 5.5

Objective A Exercises, page 339

1. $x\left(x^2 - 3x - 4\right) = x\left(x^2\right) - x(3x) - x(4)$
$= x^3 - 3x^2 - 4x$

2. $y\left(3y^2 + 4y - 8\right) = y\left(3y^2\right) + y(4y) - y(8)$
$= 3y^3 + 4y^2 - 8y$

3. $4a(2a^2+3a-6)=4a(2a^2)+4a(3a)-4a(6)$
$=8a^3+12a^2-24a$

4. $3b(6b^2-5b-7)=3b(6b^2)-3b(5b)-3b(7)$
$=18b^3-15b^2-21b$

5. $-2a(3a^2+9a-7)=-2a(3a^2)+(-2a)(9a)-(-2a)(7)$
$=-6a^3-18a^2+14a$

6. $-4x(x^2-3x-7)=-4x(x^2)-(-4x)(3x)-(-4x)(7)$
$=-4x^3+12x^2+28x$

7. $m^3(4m-9)=m^3(4m)-m^3(9)$
$=4m^4-9m^3$

8. $r^2(2r^2+7)=r^2(2r^2)+r^2(7)$
$=2r^4+7r^2$

9. $2x^3(5x^2-6xy+2y^2)=2x^3(5x^2)-2x^3(6xy)+2x^3(2y^2)$
$10x^5-12x^4y+4x^3y^2$

10. $4b^4(3a^2+4ab-b^2)=4b^4(3a^2)+4b^4(4ab)-4b^4(b^2)$
$=12a^2b^4+16ab^5-4b^6$

11. $-6r^5(r^2-2r-6)=-6r^5(r^2)-(-6r^5)(2r)-(-6r^5)(6)$
$=-6r^7+12r^6+36r^5$

12. $-5y^4(3y^2-6y^3+7)=-5y^4(3y^2)-(-5y^4)(6y^3)+(-5y^4)(7)$
$=-15y^6+30y^7-35y^4$

13. $4a^2(3a^2+6a-7)=4a^2(3a^2)+4a^2(6a)-4a^2(7)$
$=12a^4+24a^3-28a^2$

14. $5b^3(2b^2-4b-9)=5b^3(2b^2)-5b^3(4b)-5b^3(9)$
$=10b^5-20b^4-45b^3$

15. $-2n^2(3-4n^3-5n^5)=-2n^2(3)-(-2n^2)(4n^3)-(-2n^2)(5n^5)$
$=-6n^2+8n^5+10n^7$

16. $-4x^3(6-4x^2-5x^4)=-4x^3(6)-(-4x^3)(4x^2)-(-4x^3)(5x^4)$
$=-24x^3+16x^5+20x^7$

17. $ab^2(3a^2-4ab+b^2)=ab^2(3a^2)-ab^2(4ab)+(ab^2)(b^2)$
$=3a^3b^2-4a^2b^3+ab^4$

18. $x^2y^3(5y^3-6xy-x^3)=x^2y^3(5y^3)-(x^2y^3)(6xy)-(x^2y^3)(x^3)$
$=5x^2y^6-6x^3y^4-x^5y^3$

19. $-x^2y^3(4x^5y^2-5x^3y-7x)=-x^2y^3(4x^5y^2)-(-x^2y^3)(5x^3y)-(-x^2y^3)(7x)$
$=-4x^7y^5+5x^5y^4+7x^3y^3$

20. $-a^2b^4(3a^6b^4+6a^3b^2-5a)=-a^2b^4(3a^6b^4)+(-a^2b^4)(6a^3b^2)-(-a^2b^4)(5a)$
$=-3a^8b^8-6a^5b^6+5a^3b^4$

21. $6r^2t^3(1-rt-r^3t^3)=6r^2t^3(1)-6r^2t^3(rt)-6r^2t^3(r^3t^3)$
$=6r^2t^3-6r^3t^4-6r^5t^6$

22. $3p(4p^2+5p-8)=3p(4p^2)+3p(5p)-3p(8)$
$=12p^3+15p^2-24p$

23. $-4q(-9q+7)=-4q(-9q)-4q(7)$
$=36q^2-28q$

Objective B Exercises, pages 339–340

24. $(x+4)(x+6)=(x)(x)+(x)(6)+4(x)+4(6)$
$=x^2+6x+4x+24$
$=x^2+10x+24$

25. $(y+9)(y+3)=(y)(y)+(y)(3)+9(y)+9(3)$
$=y^2+3y+9y+27$
$=y^2+12y+27$

26. $(a-6)(a-7)=(a)(a)+a(-7)+(-6)(a)+(-6)(-7)$
$=a^2-7a-6a+42$
$=a^2-13a+42$

27. $(x+6)(x+5)=(x)(x)+(x)(5)+6(x)+6(5)$
$=x^2+5x+6x+30$
$=x^2+11x+30$

28. $(y+4)(y+3)=(y)(y)+(y)(3)+4(y)+4(3)$
$=y^2+3y+4y+12$
$=y^2+7y+12$

29. $(a-3)(a-8)=(a)(a)+(a)(-8)+(-3)(a)+(-3)(-8)$
$=a^2-8a-3a+24$
$=a^2-11a+24$

30. $(3c+4)(2c+3)=(3c)(2c)+(3c)(3)+4(2c)+4(3)$
$=6c^2+9c+8c+12$
$=6c^2+17c+12$

31. $(5z+2)(2z+1)=(5z)(2z)+(5z)(1)+(2)(2z)+2(1)$
$=10z^2+5z+4z+2$
$=10z^2+9z+2$

32. $(3v-7)(4v+3)=(3v)(4v)+(3v)(3)+(-7)(4v)+(-7)(3)$
$=12v^2+9v-28v-21$
$=12v^2-19v-21$

33. $(8c-7)(5c+3)=(8c)(5c)+8c(3)+(-7)(5c)+(-7)(3)$
$=40c^2+24c-35c-21$
$=40c^2-11c-21$

34. $(8x-3)(5x-4)=(8x)(5x)+(8x)(-4)+(-3)(5x)+(-3)(-4)$
$=40x^2-32x-15x+12$
$=40x^2-47x+12$

35. $(5v-3)(2v-1)=(5v)(2v)+(5v)(-1)+(-3)(2v)+(-3)(-1)$
$=10v^2-5v-6v+3$
$=10v^2-11v+3$

36. $(4n-9)(4n-5)=(4n)(4n)+(4n)(-5)+(-9)(4n)+(-9)(-5)$
$=16n^2-20n-36n+45$
$=16n^2-56n+45$

37. $(7t-2)(5t+4)=(7t)(5t)+(7t)(4)+(-2)(5t)+(-2)(4)$
$=35t^2+28t-10t-8$
$=35t^2+18t-8$

38. $(3y-4)(4y+7)=(3y)(4y)+(3y)(7)+(-4)(4y)+(-4)(7)$
$=12y^2+21y-16y-28$
$=12y^2+5y-28$

39. $(8x+5)(3x-2)=(8x)(3x)+(8x)(-2)+5(3x)+5(-2)$
$=24x^2-16x+15x-10$
$=24x^2-x-10$

40. $(4a-5)(4a+5)=(4a)(4a)+(4a)(5)+(-5)(4a)+(-5)(5)$
$=16a^2+20a-20a-25$
$=16a^2-25$

41. $(5r+2)(5r-2)=(5r)(5r)+(5r)(-2)+2(5r)+2(-2)$
$=25r^2-10r+10r-4$
$=25r^2-4$

42. $(2b+3)(3b+8)=(2b)(3b)+(2b)(8)+3(3b)+3(8)$
$=6b^2+16b+9b+24$
$=6b^2+25b+24$

43. $(7y+5)(3y-8)=(7y)(3y)+(7y)(-8)+5(3y)+5(-8)$
$=21y^2-56y+15y-40$
$=21y^2-41y-40$

Critical Thinking 5.5, page 340

44. Strategy To find the area, substitute $(3y^2 + y + 4)$ for L and $(2y)$ for W in the formula below and solve for A.

Solution $A = LW$
$A = (3y^2 + y + 4) \cdot 2y = 3y^2 \cdot 2y + y \cdot 2y + 4 \cdot 2y$
$= 6y^3 + 2y^2 + 8y$
The area is $(6y^3 + 2y^2 + 8y)$ in^2.

45. Strategy To find the area, substitute $(2x + 3)$ for L and $(x - 6)$ for W in the formula below and solve for A.

Solution $A = LW$
$A = (2x + 3) \cdot (x - 6) = (2x)(x) + (2x)(-6) + 3(x) + 3(-6)$
$= 2x^2 - 12x + 3x - 18$
$= 2x^2 - 9x - 18$
The area is $(2x^2 - 9x - 18)$ mi^2.

46. Strategy To find the area, substitute $(2x + 1)$ for s in the formula below and solve for A.

Solution $A = s^2$
$A = (2x + 1)^2 = (2x + 1)(2x + 1)$
$= (2x)(2x) + 2x(1) + 1(2x) + (1)(1)$
$= 4x^2 + 4x + 1$
The area is $(4x^2 + 4x + 1)$ m^2.

47. a. $(5+x)^2 = 25 + x^2$ False
$(5+x)^2 = (5+x)(5+x) = 25 + 5x + 5x + x^2 = 25 + 10x + x^2$

b. $(5x)^2 = 25x^2$ True

c. $(a-4)^2 = a^2 - 16$ False
$(a-4)^2 = (a-4)(a-4) = a^2 - 8a + 16$

48. $(a-b)^2 - (a+b)^2 = (a^2 - 2ab + b^2) - (a^2 + 2ab + b^2) = -4ab$

Section 5.6

Objective A Exercises, page 345

1. $27^0 = 1$

2. $(3x)^0 = 1$

3. $-(17)^0 = -1$

4. $-(2a)^0 = -1$

5. $3^{-2} = \frac{1}{3^2} = \frac{1}{9}$

6. $4^{-3} = \frac{1}{4^3} = \frac{1}{64}$

7. $2^{-3} = \frac{1}{2^3} = \frac{1}{8}$

8. $5^{-2} = \frac{1}{5^2} = \frac{1}{25}$

9. $x^{-5} = \frac{1}{x^5}$

10. $v^{-3} = \frac{1}{v^3}$

11. $w^{-8} = \frac{1}{w^8}$

12. $m^{-9} = \frac{1}{m^9}$

13. $y^{-1} = \frac{1}{y}$

14. $d^{-4} = \frac{1}{d^4}$

15. $\frac{1}{a^{-5}} = a^5$

16. $\frac{1}{c^{-6}} = c^6$

17. $\frac{1}{b^{-3}} = b^3$

18. $\frac{1}{y^{-7}} = y^7$

19. $\frac{a^8}{a^2} = a^{8-2} = a^6$

20. $\frac{c^{12}}{c^5} = c^{12-5} = c^7$

21. $\frac{q^5}{q} = q^{5-1} = q^4$

22. $\frac{r^{10}}{r} = r^{10-1} = r^9$

23. $\frac{m^4n^7}{m^3n^5} = m^{4-3}n^{7-5} = mn^2$

24. $\frac{a^5b^6}{a^3b^2} = a^{5-3}b^{6-2} = a^2b^4$

25. $\frac{t^4u^8}{t^2u^5} = t^{4-2}u^{8-5} = t^2u^3$

26. $\frac{b^{11}c^5}{b^4c} = b^{11-4}c^{5-1} = b^7c^4$

27. $\frac{x^4}{x^9} = x^{4-9} = x^{-5} = \frac{1}{x^5}$

28. $\frac{r^2}{r^5} = r^{2-5} = r^{-3} = \frac{1}{r^3}$

29. $\frac{b}{b^5} = b^{1-5} = b^{-4} = \frac{1}{b^4}$

30. $\frac{m^5}{m^8} = m^{5-8} = m^{-3} = \frac{1}{m^3}$

Objective B Exercises, pages 345–346

31. $2{,}370{,}000 = 2.37 \times 10^6$

32. $75{,}000 = 7.5 \times 10^4$

33. $0.00045 = 4.5 \times 10^{-4}$

34. $0.000076 = 7.6 \times 10^{-5}$

35. $309{,}000 = 3.09 \times 10^5$

36. $819{,}000{,}000 = 8.19 \times 10^8$

37. $0.000000601 = 6.01 \times 10^{-7}$

38. $0.00000000096 = 9.6 \times 10^{-10}$

39. $57{,}000{,}000{,}000 = 5.7 \times 10^{10}$

40. $934{,}800{,}000{,}000 = 9.348 \times 10^{11}$

41. $0.000000017 = 1.7 \times 10^{-8}$

42. $0.0000009217 = 9.217 \times 10^{-7}$

43. $7.1 \times 10^5 = 710{,}000$

44. $2.3 \times 10^7 = 23{,}000{,}000$

45. $4.3 \times 10^{-5} = 0.000043$

46. $9.21 \times 10^{-7} = 0.000000921$

47. $6.71 \times 10^8 = 671,000,000$

48. $5.75 \times 10^9 = 5,750,000,000$

49. $7.13 \times 10^{-6} = 0.00000713$

50. $3.54 \times 10^{-8} = 0.0000000354$

51. $5 \times 10^{12} = 5,000,000,000,000$

52. $1.0987 \times 10^{11} = 109,870,000,000$

53. $8.01 \times 10^{-3} = 0.00801$

54. $4.0162 \times 10^{-9} = 0.0000000040162$

55. $16,000,000,000,000$ mi
$= 1.6 \times 10^{13}$ mi

56. $5,980,000,000,000,000,000,000,000$ kg
$= 5.98 \times 10^{24}$ kg

57. 0.00000000000000000016 coulombs
$= 1.6 \times 10^{-19}$ coulombs

58. 0.0000037 m $= 3.7 \times 10^{-6}$ m

59. 0.000000001 s $= 1 \times 10^{-9}$ s

60. $73,900,000,000 = 7.39 \times 10^{10}$ dollars

Critical Thinking 5.6, page 346

61. a. $3.45 \times 10^{-14} > 6.45 \times 10^{-15}$

b. $5.23 \times 10^{18} > 5.23 \times 10^{17}$

c. $3.12 \times 10^{12} > 4.23 \times 10^{11}$

d. $-6.81 \times 10^{-24} < -9.37 \times 10^{-25}$

62. a. $3^{-(-2)} = 3^2 = 9,\ 3^{-(-1)} = 3^1 = 3,$
$3^{-0} = 3^0 = 1,\ 3^{-1} = \frac{1}{3},$
$3^{-2} = \frac{1}{3^2} = \frac{1}{9}$

b. $2^{-(-2)} = 2^2 = 4,\ 2^{-(-1)} = 2^1 = 2,$
$2^{-0} = 2^0 = 1,\ 2^{-1} = \frac{1}{2},$
$2^{-2} = \frac{1}{2^2} = \frac{1}{4}$

Section 5.7

Objective A Exercises, page 351

1. Three more than t
$t + 3$

2. the total of twice q and five
$2q + 5$

3. five less than the product of six and m
$6m - 5$

4. seven subtracted from the product of eight and d
$8d - 7$

5. the difference between three times b and seven
$3b - 7$

6. the difference between six times c and twelve
$6c - 12$

7. the product of n and seven
$7n$

8. the quotient of nine times k and seven
$\frac{9k}{7}$

9. twice the sum of three and w
$2(3 + w)$

10. six times the difference between y and eight
$6(y - 8)$

11. four times the difference between twice r and five
$4(2r - 5)$

12. seven times the total of p and ten
$7(p + 10)$

13. the quotient of v and the difference between v and 4
$\frac{v}{v - 4}$

14. x divided by the sum of x and one
$\frac{x}{x + 1}$

15. four times the square of t
$4t^2$

16. six times the cube of q
$6q^3$

17. The sum of the square of m and the cube of m
$m^2 + m^3$

18. the difference between the square of d and d
$d^2 - d$

19. smaller numbers: s
larger number: $31 - s$
five more than the larger number
$(31 - s) + 5$

20. larger number: L
smaller number: $74 - L$
the quotient of the larger number and the smaller number
$\frac{L}{74 - L}$

Objective B Exercises, pages 351–353

21. Let the number be x.
a number decreased by the total of the number and twelve
$x - (x + 12)$
$x - x - 12$
-12

22. Let the number be x.
a number decreased by the difference between six and the number
$x - (6 - x)$
$x - 6 + x$
$2x - 6$

23. Let the number be x.
the difference between two thirds of a number and three eighths of the number
$\frac{2}{3}x - \frac{3}{8}x$
$\frac{16}{24}x - \frac{9}{24}x$
$\frac{7}{24}x$

24. Let the number be x.
two more than the total of a number and 5
$(x + 5) + 2$
$x + 5 + 2$
$x + 7$

25. Let the number be x.
twice the sum of seven times a number and six
$2(7x + 6)$
$14x + 12$

26. Let the number be x.
five times the product of seven and a number
$5(7x)$
$35x$

27. Let the number be x.
the sum of eleven times a number and the product of three and the number
$11x + 3x$
$14x$

28. Let the number be x.
a number plus the product of the number and ten
$x + 10x$
$11x$

29. Let the number be x.
nine times the sum of a number and seven
$9(x + 7)$
$9x + 63$

30. Let the number be x.
a number added to the product of four and the number
$4x + x$
$5x$

31. Let the number be x.
seven more than the sum of a number and five
$(x + 5) + 7$
$x + 12$

32. Let the number be x.
a number minus the sum of the number and six
$x - (x + 6)$
$x - x - 6$
-6

33. Let the number be x.
the product of seven and the difference between a number and four
$7(x - 4)$
$7x - 28$

34. Let the number be x.
six times the difference between a number and three
$6(x-3)$
$6x-18$

35. Let the number be x.
the difference between ten times a number and the product of three and the number
$10x-3x$
$7x$

36. Let the number be x.
fifteen more than the difference between a number and seven
$(x-7)+15$
$x+8$

37. Let the number be x.
the sum of a number and twice the difference between the number and four
$x+2(x-4)$
$x+2x-8$
$3x-8$

38. Let the number be x.
the difference between a number and the total of three times the number and five
$x-(3x+5)$
$x-3x-5$
$-2x-5$

39. Let the number be x.
seven times the difference between a number and fourteen
$7(x-14)$
$7x-98$

40. Let the number be x.
the product of three and the sum of a number and twelve
$3(x+12)$
$3x+36$

41. Let the number be x.
the product of eight and the sum of a number and ten
$8(x+10)$
$8x+80$

42. Let the number be x.
the difference between the square of a number and the total of twelve and the square of the number
$x^2-\left(12+x^2\right)$
x^2-12-x^2
-12

43. Let the number be x.
a number increased by the difference between seven times the number and eight
$x+(7x-8)$
$x+7x-8$
$8x-8$

44. Let the number be x.
the product of ten and the total of a number and one
$10(x+1)$
$10x+10$

45. Let the number be x.
five increased by twice the sum of a number and fifteen
$5+2(x+15)$
$5+2x+30$
$2x+35$

46. Let the number be x.
eleven less than the difference between a number and eight
$(x-8)-11$
$x-19$

47. Let the number be x.
fourteen decreased by the sum of a number and thirteen
$14-(x+13)$
$14-x-13$
$1-x$

48. Let the number be x.
eleven minus the sum of a number and six
$11-(x+6)$
$11-x-6$
$5-x$

49. Let the number be x.
the product of eight times a number and two
$8x\cdot 2$
$16x$

50. Let the number be x.
eleven more than a number added to the difference between the number and seventeen
$(11 + x) + (x - 17)$
$11 + x + x - 17$
$2x - 6$

51. Let the number be x.
a number plus nine added to the difference between four times the number and three
$(x + 9) + (4x - 3)$
$x + 9 + 4x - 3$
$5x + 6$

52. Let the number be x.
the sum of a number and ten added to the difference between the number and eleven
$(x + 10) + (x - 11)$
$x + 10 + x - 11$
$2x - 1$

53. Let the smaller number be y.
The larger number is $9 - y$.
five times the larger number
$5(9 - y)$
$45 - 5y$

54. Let the smaller number be p.
The larger number is $14 - p$.
eight less than the larger number
$(14 - p) - 8$
$14 - p - 8$
$6 - p$

55. Let the larger number be m.
The smaller number is $17 - m$.
nine less than three times the smaller number
$3(17 - m) - 9$
$51 - 3m - 9$
$42 - 3m$

56. Let the larger number be k.
The smaller number is $19 - k$.
the difference between twice the smaller number and ten
$2(19 - k) - 10$
$38 - 2k - 10$
$28 - 2k$

Objective C Exercises, pages 353–354

57. the distance from Earth to the moon: d
the distance from Earth to the sun: $390d$

58. length of an ultraviolet ray: L
length of an infrared ray: $2L$

59. the height of Mount Whitney: H
the height of Mount Everest: $H + 4{,}430$

60. the width of the door: w
the height of the door: $w + 5$

61. the amount of cashews: A
the amount of peanuts: $3A$

62. the time to fill out Schedule B: t
the time to fill out Schedule A: $5t$

63. the regular price of a suit: c
the sale price of the suit: $\frac{3}{4}c$

64. the speed of the slower cyclist: r
the speed of the faster cyclist: $r + 6$

65. the longer piece of the string: L
the shorter piece of the string: $3 - L$

66. the price of the stock: p
the amount of the dividend: $\frac{1}{20}p$

67. the length of the shorter piece: L
the length of the longer piece: $12 - L$

Critical Thinking 5.7, page 354

68. The sides of a square are equal in length. Thus each side of the square would have a length of one-fourth the length of the wire, or each side $= \frac{1}{4}x$.

69. There are twice as many hydrogen atoms as oxygen atoms in the water. Thus if there are x oxygen atoms, there will be 2x hydrogen atoms.

70. For each 5 ft the rope moves, the weight will move 3 ft. Thus the weight will move $\frac{3}{5}$ the distance of the rope. Using these distances as a model, if the rope moves a distance of x, the weight will move $\frac{3}{5}x$.

71. For each 7 turns of the smaller wheel, the larger wheel turns 4 times. Thus the larger wheel will make $\frac{4}{7}$ as many turns as the smaller wheel.

Chapter Review Exercises, pages 359–360

1. $-3x - 7 + 5x - 9 = (-3x + 5x) + (-7 - 9)$
$= 2x - 16$

2. $-2(9z + 1) = -18z - 2$

3. $(3z^2 + 4z - 7) + (7z^2 - 5z - 8)$
$= (3z^2 + 7z^2) + (4z - 5z) + (-7 - 8)$
$= 10z^2 - z - 15$

4. $(2m^3n)(-4m^2n) = [2(-4)](m^3 \cdot m^2)(n \cdot n)$
$= -8m^5n^2$

5. $3^{-5} = \frac{1}{3^5} = \frac{1}{243}$

6. The additive inverse of $\frac{3}{7}$ is $-\frac{3}{7}$.

7. $\frac{2}{3}\left(\frac{3}{2}x\right) = x$

8. $-5(2s - 5t) + 6(3t + s)$
$= -10s + 25t + 18t + 6s$
$= -4s + 43t$

9. $(-5xy^4)(-3x^2y^3)$
$= [(-5)(-3)](x \cdot x^2)(y^4 \cdot y^3)$
$= 15x^3y^7$

10. $(7a + 6)(3a - 4) = 21a^2 - 28a + 18a - 24$
$= 21a^2 - 10a - 24$

11. $$\begin{array}{r} 6b^3 - 7b^2 + 5b - 9 \\ \underline{-9b^3 + 7b^2 - b - 9} \\ -3b^3 \qquad\quad + 4b - 18 \end{array}$$

12. $(2z^4)^5 = 2^{1 \cdot 5}z^{4 \cdot 5} = 2^5z^{20} = 32z^{20}$

13. $-\frac{3}{4}(-8w) = 6w$

14. $5xyz^2(-3x^2z + 6yz^2 - x^3y^4) = 5xyz^2(-3x^2z) + 5xyz^2(6yz^2) - 5xyz^2(x^3y^4)$
$= -15x^3yz^3 + 30xy^2z^4 - 5x^4y^5z^2$

15. The multiplicative inverse of $-\frac{9}{4}$ is $-\frac{4}{9}$.

16. $-4(3c-8)=-12c+32$

17. $2m-6n+7-4m+6n+9=(2m-4m)+(-6n+6n)+(7+9)$
$=-2m+16$

18. $(4a^3b^8)(-3a^2b^7)=[4(-3)](a^3\cdot a^2)(b^8\cdot b^7)$
$=-12a^5b^{15}$

19. The Distributive Property

20. $(p^2q^3)^3=p^{2\cdot 3}q^{3\cdot 3}$
$=p^6q^9$

21. $\dfrac{a^4}{a^{11}}=a^{4-11}=a^{-7}$
$=\dfrac{1}{a^7}$

22. $0.0000397=3.97\times 10^{-5}$

23. The Commutative Property of Addition

24. $(9y^3+8y^2-10)+(-6y^3+8y-9)=(9y^3-6y^3)+8y^2+8y+(-10-9)$
$=3y^3+8y^2+8y-19$

25. $8(2c-3d)-4(c-5d)=16c-24d-4c+20d$
$=12c-4d$

26. $7(2m-6)=14m-42$

27. $\dfrac{x^3y^5}{xy}=x^{3-1}y^{5-1}=x^2y^4$

28. $7a^2+9-12a^2+3a=(7a^2-12a^2)+3a-9$
$=-5a^2+3a+9$

29. $(3p-9)(4p+7)=12p^2+21p-36p-63$
$=12p^2-15p-63$

30. $-2a^2b(4a^3-5ab^2+3b^4)=-2a^2b(4a^3)-(-2a^2b)(5ab^2)+(-2a^2b)+(3b^4)$
$=-8a^5b+10a^3b^3-6a^2b^5$

31. $-12x+7y+15x-11y=(-12x+15x)+(7y-11y)$
$=3x-4y$

32. $-7(3a-4b)-5(3b-4a)=-21a+28b-15b+20a$
$=-a+13b$

33. $c^{-5}=\dfrac{1}{c^5}$

34.
$$\begin{array}{r}
12x^3 + 9x^2 - 5x - 1 \\
\underline{-6x^3 - 9x^2 - 5x + 1} \\
6x^3 \qquad\qquad -10x
\end{array}$$

35. $2.4\times10^5 = 240{,}000$

36. $4z^2 + 3z - 9z + 2z^2$
$= (4z^2 + 2z^2) + (3z - 9z)$
$= 6z^2 - 6z$

37. nine <u>less than</u> the quotient of four <u>times</u> a number and seven
$\frac{4x}{7} - 9$

38. the <u>sum</u> of three <u>times</u> a number and twice the <u>difference</u> between the number and seven
$3x + 2(x - 7)$
$3x + 2x - 14$
$5x - 14$

39. $602{,}300{,}000{,}000{,}000{,}000{,}000{,}000 = 6.023\times10^{23}$

40. the number of pounds of mocha java beans: p
the number of pounds of espresso beans: $30 - p$

Chapter Test, pages 361–362

1. $\frac{2}{3}\left(-\frac{3}{2}r\right) = -r$

2. $-3(5y - 7) = -15y + 21$

3. $7y - 3 - 4y + 6$
$= (7y - 4y) + (-3 + 6)$
$= 3y + 3$

4. $4x^2 - 2z + 7z - 8x^2$
$= (4x^2 - 8x^2) + (-2z + 7z)$
$= -4x^2 + 5z$

5. $2a - 4b + 12 - 5a - 2b + 6$
$= (2a - 5a) + (-4b - 2b) + (12 + 6)$
$= -3a - 6b + 18$

6. The multiplicative inverse of $\frac{5}{4}$ is $\frac{4}{5}$.

7. $-2(3x - 4y) + 5(2x + y)$
$= -6x + 8y + 10x + 5y$
$= 4x + 13y$

8. $9 - 2(4b - a) + 3(3b - 4a)$
$= 9 - 8b + 2a + 9b - 12a$
$= -10a + b + 9$

9. $0.00000079 = 7.9\times10^{-7}$

10. $4.9\times10^6 = 4{,}900{,}000$

11. $(4x^2 - 2x - 2) + (2x^2 - 3x + 7)$
$= (4x^2 + 2x^2) + (-2x - 3x) + (-2 + 7)$
$= 6x^2 - 5x + 5$

12. $(v^2w^5)^4 = v^{2\cdot4}w^{5\cdot4} = v^8w^{20}$

13. $(3m^2n^3)^3 = 3^{1\cdot3}m^{2\cdot3}n^{3\cdot3}$
$= 33m^6n^9 = 27m^6n^9$

14. $(-5v^2z)(2v^3z^2) = (-5)(2)(v^2\cdot v^3)(z\cdot z^2)$
$= -10v^5z^3$

15. $(3p - 8)(2p + 5) = 6p^2 + 15p - 16p - 40$
$= 6p^2 - p - 40$

16. $(2m^2n^2)(-4mn^3 + 2m^3 - 3n^4)$
$= 2m^2n^2(-4mn^3) + 2m^2n^2(2m^3) + 2m^2n^2(-3n^4)$
$= -8m^3n^5 + 4m^5n^2 - 6m^2n^6$

17. $3z + 4w = 4w + 3z$

18. $\frac{x^2y^5}{xy^2} = x^{2-1}y^{5-2} = xy^3$

19. $a^{-5} = \frac{1}{a^5}$

20. The Associative Property of Multiplication

21. $$\begin{array}{rrrr} 5a^3 & -6a^2 & +4a & -8 \\ -8a^3 & +7a^2 & -4a & -2 \\ \hline -3a^3 & +a^2 & & -10 \end{array}$$

22. $\frac{1}{c^{-6}} = c^6$

23. The Distributive Property

24. $6w \cdot 0 = 0$

25. $(3x - 7y)(3x + 7y)$
$= 9x^2 + 21xy - 21xy - 49y^2$
$= 9x^2 - 49y^2$

26. The additive inverse of $-\frac{4}{7}$ is $\frac{4}{7}$.

27. $720{,}000{,}000 = 7.2 \times 10^8$

28. $(3a - 6)(4a + 2)$
$= 12a^2 + 6a - 24a - 12$
$= 12a^2 - 18a - 12$

29. $2(4a - 3b) + 3(5a - 2b)$
$= 8a - 6b + 15a - 6b$
$= 23a - 12b$

30. $\frac{m^4n^2}{m^2n^5} = m^{4-2}n^{2-5} = \frac{m^2}{n^3}$

31. five more than three times a number
$3x + 5$

32. the sum of a number and four times the difference between the number and seven
$x + 4(x - 7)$
$x + 4x - 28$
$5x - 28$

33. the number of cups of sugar in the batter: s
the number of cups of flour in the batter: $s + 3$

Cumulative Review Exercises, pages 363–364

1. $\frac{4.712}{-0.38} = -12.4$

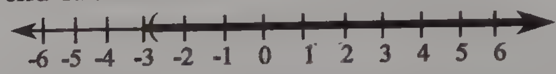
2. $9v - 10 + 5v + 8 = (9v + 5v) + (-10 + 8)$
$14v - 2$

3. $(3x - 5)(2x + 4) = 6x^2 + 12x - 10x - 20$
$= 6x^2 + 2x - 20$

4. $-a - b$, $a = \frac{11}{24}$ and $b = -\frac{5}{6}$
$-\frac{11}{24} - \left(-\frac{5}{6}\right) = \frac{-11}{24} - \frac{-5}{6}$
$= \frac{-11}{24} - \frac{-20}{24}$
$= \frac{-11-(-20)}{24} = \frac{-11+20}{24}$
$= \frac{9}{24} = \frac{3\cdot 3}{3\cdot 8} = \frac{3}{8}$

5. $\sqrt{81} + 3\sqrt{25} = 9 + 3\cdot 5$
$= 9 + 15$
$= 24$

6. Draw a parenthesis at -3. Draw a line to the right of -3. Draw an arrow at the right end of the line.



7. $\frac{1}{x^{-7}} = x^7$

8. $-4t = 36$
$\frac{-4t}{-4} = \frac{36}{-4}$
$t = -9$
The solution is -9.

9. $0.00000084 = 8.4 \times 10^{-7}$

10.
$(5x^2 - 3x + 2) + (4x^2 + x - 6)$
$= (5x^2 + 4x^2) + (-3x + x) + (2 - 6)$
$= 9x^2 - 2x - 4$

11. $-5\sqrt{x + y}$, $x = 18$ and $y = 31$
$-5\sqrt{18 + 31} = -5\sqrt{49}$
$= -5 \cdot 7 = -35$

12. $\frac{\frac{5}{8} + \frac{3}{4}}{3 - \frac{1}{2}} = \frac{\frac{11}{8}}{\frac{5}{2}}$
$= \frac{11}{8} \div \frac{5}{2}$
$= \frac{11}{8} \cdot \frac{2}{5}$
$= \frac{11\cdot 2}{8\cdot 5} = \frac{11\cdot 2}{2\cdot 2\cdot 2\cdot 5} = \frac{11}{20}$

13. $(-3a^2b)(4a^5b^8) = (-3\cdot 4)(a^2 \cdot a^5)(b \cdot b^8)$
$= -12a^7b^9$

14. $\frac{x^3}{x^5} = x^{3-5}$
$= x^{-2}$
$= \frac{1}{x^2}$

15. x^3y^2, $x = \frac{2}{5}$ and $y = 2\frac{1}{2}$
$\left(\frac{2}{5}\right)^3\left(2\frac{1}{2}\right)^2 = \left(\frac{2}{5}\cdot\frac{2}{5}\cdot\frac{2}{5}\right)\left(\frac{5}{2}\cdot\frac{5}{2}\right)$
$= \frac{2\cdot2\cdot2\cdot5\cdot5}{5\cdot5\cdot5\cdot2\cdot2} = \frac{2}{5}$

16. $-8p(6) = (6)(-8p) = [(6)(-8)]p = -48p$

17.
$829.42 \rightarrow 800$
$567.109 \rightarrow -600$
200

18. $-3ab^2\left(4a^2b + 5ab - 2ab^2\right)$
$= -3ab^2(4a^2b) + (-3ab^2)(5ab) - (-3ab^2)(-2ab^2)$
$= -12a^3b^3 - 15a^2b^3 + 6a^2b^4$

19. $6(5x - 4y) - 12(x - 2y)$
$= 30x - 24y - 12x + 24y$
$= 18x$

20. $\frac{a}{-b}$, $a = -56$ and $b = -8$
$\frac{-56}{-(-8)} = \frac{-56}{8} = -7$

21. $0.5625 = \frac{5625}{10{,}000} = \frac{625\cdot9}{625\cdot16} = \frac{9}{16}$

22. $6\cdot(-2)^3 \div 12 - (-8) = 6\cdot(-8) \div 12 - (-8)$
$= -48 \div 12 - (-8)$
$= -4 - (-8)$
$= -4 + 8 = 4$

23. $\sqrt{300} = \sqrt{100\cdot3}$
$= \sqrt{100}\cdot\sqrt{3}$
$= 10\sqrt{3}$

24. $\left(8y^2 - 7y + 4\right) - \left(3y^2 - 5y + 9\right)$
$= \left(8y^2 - 7y + 4\right) + \left(-3y^2 + 5y - 9\right)$
$= 5y^2 - 2y - 5$

25. $-6cd$, $c = -\frac{2}{9}$ and $d = \frac{3}{4}$
$-6\left(-\frac{2}{9}\right)\left(\frac{3}{4}\right) = \frac{6}{1}\cdot\frac{2}{9}\cdot\frac{3}{4}$
$= \frac{6\cdot2\cdot3}{1\cdot9\cdot4}$
$= \frac{2\cdot3\cdot2\cdot3}{1\cdot3\cdot3\cdot2\cdot2} = 1$

26. $-\left(3a^2\right)^0 = -1$

27. $\left(2a^4b^3\right)^5 = 2^{1\cdot5}a^{4\cdot5}b^{3\cdot5}$
$= 2^5a^{20}b^{15}$
$= 32a^{20}b^{15}$

28. $(a-b)^2 + 5c$; $a = -4$, $b = 6$, $c = -2$
$(-4-6)^2 + 5(-2) = (-10)^2 + 5(-2)$
$= 100 + 5(-2)$
$= 100 + (-10)$
$= 90$

29. $2\frac{4}{5}\cdot\frac{6}{7} = \frac{14}{5}\cdot\frac{6}{7}$
$= \frac{14\cdot6}{5\cdot7}$
$= \frac{2\cdot7\cdot2\cdot3}{5\cdot7}$
$= \frac{12}{5} = 2\frac{2}{5}$

30. $6.23\times10^{-5} = 0.0000623$

31. Let the unknown number be x.
the quotient of ten and the difference between a number and nine
$\frac{10}{x-9}$

32. Let the unknown number be x.
two less than twice the sum of a number and four
$2(x + 4) - 2$
$2x + 8 - 2$
$2x + 6$

33. Strategy To find the difference, subtract the average rainfall in El Paso (7.82) from the average rainfall in Seattle (38.6).

Solution $38.6 - 7.82 = 30.78$
The difference between the average annual rainfall in Seattle and El Paso is 30.78 in.

34. Strategy To find the difference, subtract the amount of trash thrown away by a person in Canada (1.73) from the amount of trash thrown away by a person in the United States (1.97). Multiply the difference by the number of days in a year (365). Round your answer.

Solution $1.97 - 1.73 = 0.24$
$0.24 \cdot 365 = 87.6$ rounded to the nearest whole number is 88
The person in the United States throws away 88 kg more trash than a person in Canada.

35. the distance from Earth to the sun: d
the distance from Neptune to the sun: $30d$

36. Strategy To find the cost, substitute $15\frac{3}{8}$ for S and 200 for N in the given formula and solve for C.

Solution $C = SN$
$C = 15\frac{3}{8} \cdot 200$
$C = 3{,}075$
The cost of the stock was \$3,075.

Chapter 6

Section 6.1

Objective A Exercises, page 373

3. $x + 3 = 9$
$x + 3 - 3 = 9 - 3$
$x = 6$
The solution is 6.

4. $y + 6 = 8$
$y + 6 - 6 = 8 - 6$
$y = 2$
The solution is 2.

5. $4 + x = 13$
$4 - 4 + x = 13 - 4$
$x = 9$
The solution is 9.

6. $9 + y = 14$
$9 - 9 + y = 14 - 9$
$y = 5$
The solution is 5.

7. $m - 12 = 5$
$m - 12 + 12 = 5 + 12$
$m = 17$
The solution is 17.

8. $n - 9 = 3$
$n - 9 + 9 = 3 + 9$
$n = 12$
The solution is 12.

9. $x - 3 = -2$
$x - 3 + 3 = -2 + 3$
$x = 1$
The solution is 1.

10. $y - 6 = -1$
$y - 6 + 6 = -1 + 6$
$y = 5$
The solution is 5.

11. $a + 5 = -2$
$a + 5 - 5 = -2 - 5$
$a = -7$
The solution is –7.

12. $b + 3 = -3$
$b + 3 - 3 = -3 - 3$
$b = -6$
The solution is –6.

13. $3 + m = -6$
$3 - 3 + m = -6 - 3$
$m = -9$
The solution is –9.

14. $5 + n = -2$
$5 - 5 + n = -2 - 5$
$n = -7$
The solution is –7.

15. $8 = x + 3$
$8 - 3 = x + 3 - 3$
$5 = x$
The solution is 5.

16. $7 = y + 5$
$7 - 5 = y + 5 - 5$
$2 = y$
The solution is 2.

17. $3 = w - 6$
$3 + 6 = w - 6 + 6$
$9 = w$
The solution is 9.

18. $4 = y - 3$
$4 + 3 = y - 3 + 3$
$7 = y$
The solution is 7.

19. $-7 = -7 + m$
$-7 + 7 = -7 + 7 + m$
$0 = m$
The solution is 0.

20. $-9 = -9 + n$
$-9 + 9 = -9 + 9 + n$
$0 = n$
The solution is 0.

21. $-3 = v + 5$
$-3 - 5 + v + 5 - 5$
$-8 = v$
The solution is –8.

22. $-1 = w + 2$
$-1 - 2 = w + 2 - 2$
$-3 = w$
The solution is –3.

23. $-5 = 1 + x$
$-5 - 1 = 1 - 1 + x$
$-6 = x$
The solution is –6.

24. $-3 = 4 + y$
$-3 - 4 = 4 - 4 + y$
$-7 = y$
The solution is –7.

25. $3 = -9 + m$
$3 + 9 = -9 + 9 + m$
$12 = m$
The solution is 12.

26. $4 = -5 + n$
$4 + 5 = -5 + 5 + n$
$9 = n$
The solution is 9.

27. $4 + x - 7 = 3$
$x - 3 = 3$
$x - 3 + 3 = 3 + 3$
$x = 6$
The solution is 6.

28. $12 + y - 4 = 8$
$8 + y = 8$
$8 - 8 + y = 8 - 8$
$y = 0$
The solution is 0.

29. $8t + 6 - 7t = -6$
$t + 6 = -6$
$t + 6 - 6 = -6 - 6$
$t = -12$
The solution is –12.

30. $-5z + 5 + 6z = 12$
$5 + z = 12$
$5 - 5 + z = 12 - 5$
$z = 7$
The solution is 7.

31. $y + \frac{4}{7} = \frac{6}{7}$
$y + \frac{4}{7} - \frac{4}{7} = \frac{6}{7} - \frac{4}{7}$
$y = \frac{2}{7}$
The solution is $\frac{2}{7}$.

32. $z + \frac{3}{5} = \frac{4}{5}$
$z + \frac{3}{5} - \frac{3}{5} = \frac{4}{5} - \frac{3}{5}$
$z = \frac{1}{5}$
The solution is $\frac{1}{5}$.

33. $x - \frac{3}{8} = \frac{1}{8}$
$x - \frac{3}{8} + \frac{3}{8} = \frac{1}{8} + \frac{3}{8}$
$x = \frac{4}{8}$
$x = \frac{1}{2}$
The solution is $\frac{1}{2}$.

34. $a - \frac{1}{6} = \frac{5}{6}$
$a - \frac{1}{6} + \frac{1}{6} = \frac{5}{6} + \frac{1}{6}$
$a = \frac{6}{6}$
$a = 1$
The solution is 1.

35. $c + \frac{2}{3} = \frac{3}{4}$
$c + \frac{2}{3} - \frac{2}{3} = \frac{3}{4} - \frac{2}{3}$
$c = \frac{9}{12} - \frac{8}{12}$
$c = \frac{1}{12}$
The solution is $\frac{1}{12}$.

36. $n + \frac{1}{3} = \frac{2}{5}$
$n + \frac{1}{3} - \frac{1}{3} = \frac{2}{5} - \frac{1}{3}$
$n = \frac{6}{15} - \frac{5}{15}$
$n = \frac{1}{15}$
The solution is $\frac{1}{15}$.

37. $w - \frac{1}{4} = \frac{3}{8}$
$w - \frac{1}{4} + \frac{1}{4} = \frac{3}{8} + \frac{1}{4}$
$w = \frac{3}{8} + \frac{2}{8}$
$w = \frac{5}{8}$
The solution is $\frac{5}{8}$.

38. $t - \frac{1}{3} = \frac{1}{2}$
$t - \frac{1}{3} + \frac{1}{3} = \frac{1}{2} + \frac{1}{3}$
$= \frac{3}{6} + \frac{2}{6}$
$t = \frac{5}{6}$
The solution is $\frac{5}{6}$.

Objective B Exercises, pages 373–374

39. $3x = 9$
$\frac{3x}{3} = \frac{9}{3}$
$x = 3$
The solution is 3.

40. $8a = 16$
$\frac{8a}{8} = \frac{16}{8}$
$a = 2$
The solution is 2.

41. $4c = -12$
$\frac{4c}{4} = \frac{-12}{4}$
$c = -3$
The solution is –3.

42. $5z = -25$
$\frac{5z}{5} = \frac{-25}{5}$
$z = -5$
The solution is –5.

43. $-2r = 16$
$\frac{-2r}{-2} = \frac{16}{-2}$
$r = -8$
The solution is –8.

44. $-6p = 72$
$\frac{-6p}{-6} = \frac{72}{-6}$
$p = -12$
The solution is –12.

45. $-4m = -28$
$\frac{-4m}{-4} = \frac{-28}{-4}$
$m = 7$
The solution is 7.

46. $-12x = -36$
$\frac{-12x}{-12} = \frac{-36}{-12}$
$x = 3$
The solution is 3.

47. $-3y = 0$
$\frac{-3y}{-3} = \frac{0}{-3}$
$y = 0$
The solution is 0.

48. $-7a = 0$
$\frac{-7a}{-7} = \frac{0}{-7}$
$a = 0$
The solution is 0.

49. $12 = 2c$
$\frac{12}{2} = \frac{2c}{2}$
$6 = c$
The solution is 6.

50. $28 = 7x$
$\frac{28}{7} = \frac{7x}{7}$
$4 = x$
The solution is 4.

51. $-72 = 18v$
$\frac{-72}{18} = \frac{18v}{18}$
$-4 = v$
The solution is –4.

52. $35 = -5p$
$\frac{35}{-5} = \frac{-5p}{-5}$
$-7 = p$
The solution is –7.

53. $-68 = -17t$
$\frac{-68}{-17} = \frac{-17t}{-17}$
$4 = t$
The solution is 4.

54. $-60 = -15y$
$\frac{-60}{-15} = \frac{-15y}{-15}$
$4 = y$
The solution is 4.

55. $12x = 30$
$\frac{12x}{12} = \frac{30}{12}$
$x = \frac{5}{2}$
The solution is $\frac{5}{2}$.

56. $9v = 15$
$\frac{9v}{9} = \frac{15}{9}$
$v = \frac{5}{3}$
The solution is $\frac{5}{3}$.

57. $-6a = 21$
$\frac{-6a}{-6} = \frac{21}{-6}$
$a = -\frac{7}{2}$
The solution is $-\frac{7}{2}$.

58. $-8c = 20$
$\frac{-8c}{-8} = \frac{20}{-8}$
$c = -\frac{5}{2}$
The solution is $-\frac{5}{2}$.

59. $28 = -12y$
$\frac{28}{-12} = \frac{-12y}{-12}$
$-\frac{7}{3} = y$
The solutions is $-\frac{7}{3}$.

60. $36 = -16z$
$\frac{36}{-16} = \frac{-16z}{-16}$
$-\frac{9}{4} = z$
The solution is $-\frac{9}{4}$.

61. $-52 = -18a$
$\frac{-52}{-18} = \frac{-18a}{-18}$
$\frac{26}{9} = a$
The solution is $\frac{26}{9}$.

62. $-40 = -30w$
$\frac{-40}{-30} = \frac{-30w}{-30}$
$\frac{4}{3} = w$
The solution is $\frac{4}{3}$.

63. $\frac{2}{3}x = 4$
$\frac{3}{2} \cdot \frac{2}{3}x = \frac{3}{2}(4)$
$x = 6$
The solution is 6.

64. $\frac{3}{4}y = 9$
$\frac{4}{3} \cdot \frac{3}{4}y = \frac{4}{3}(9)$
$y = 12$
The solution is 12.

65. $\frac{1}{3}a = -12$
$\frac{3}{1} \cdot \frac{1}{3}a = \frac{3}{1}(-12)$
$a = -36$
The solution is –36.

66. $\frac{3y}{5} = -15$
$\frac{5}{3} \cdot \frac{3}{5}y = \frac{5}{3}(-15)$
$y = -25$
The solution is –25.

67. $-\frac{4c}{7} = 16$
$-\frac{7}{4}\left(-\frac{4}{7}c\right) = -\frac{7}{4}(16)$
$c = -28$
The solution is –28.

68. $-\frac{5n}{8} = 20$
$-\frac{8}{5}\left(-\frac{5}{8}n\right) = -\frac{8}{5}(20)$
$n = -32$
The solution is –32.

69. $-\frac{z}{4} = -3$
$-\frac{4}{1}\left(-\frac{1}{4}z\right) = -\frac{4}{1}(-3)$
$z = 12$
The solution is 12.

70. $-\frac{3x}{8} = -15$
$-\frac{8}{3}\left(-\frac{3}{8}x\right) = -\frac{8}{3}(-15)$
$x = 40$
The solution is 40.

71. $8 = \frac{4}{5}y$
$\frac{5}{4}(8) = \frac{5}{4}\cdot\frac{4}{5}y$
$10 = y$
The solution is 10.

72. $10 = -\frac{5}{6}c$
$-\frac{6}{5}(10) = -\frac{6}{5}\left(-\frac{5}{6}c\right)$
$-12 = c$
The solution is –12.

73. $\frac{5y}{6} = \frac{7}{12}$
$\frac{6}{5}\left(\frac{5}{6}y\right) = \frac{6}{5}\left(\frac{7}{12}\right)$
$y = \frac{7}{10}$
The solution is $\frac{7}{10}$.

74. $\frac{-3v}{4} = -\frac{7}{8}$
$-\frac{4}{3}\left(-\frac{3}{4}v\right) = -\frac{4}{3}\left(-\frac{7}{8}\right)$
$v = \frac{7}{6}$
The solution is $\frac{7}{6}$.

75. $7y - 9y = 10$
$-2y = 10$
$\frac{-2y}{-2} = \frac{10}{-2}$
$y = -5$
The solution is –5.

76. $8w - 5w = 9$
$3w = 9$
$\frac{3w}{3} = \frac{9}{3}$
$w = 3$
The solution is 3.

77. $m - 4m = 21$
$-3m = 21$
$\frac{-3m}{-3} = \frac{21}{-3}$
$m = -7$
The solution is –7.

78. $2a - 6a = 10$
$-4a = 10$
$\frac{-4a}{-4} = \frac{10}{-4}$
$a = -\frac{5}{2}$
The solution is $-\frac{5}{2}$.

Critical Thinking 6.1, page 360

79. a. $x + a = b$
$x + a - a = b - a$
$x = b - a$
The solution is valid for all real numbers a and b.

b. $ax = b$
$\frac{ax}{a} = \frac{b}{a}$
$x = \frac{b}{a}$
No, the solution is not valid for $a = 0$.

80. a. $\frac{2}{\frac{1}{x}} = 8$
$2 \div \frac{1}{x} = 8$
$2 \cdot \frac{x}{1} = 8$
$2x = 8$
$\frac{2x}{2} = \frac{8}{2}$
$x = 4$

b. $\frac{3}{\frac{2}{x}} = 6$
$3 \div \frac{2}{x} = 6$
$3 \cdot \frac{x}{2} = 6$
$\frac{2}{3}\left(\frac{3}{2}x\right) = \frac{2}{3}(6)$
$x = 4$

Section 6.2

Objective A Exercises, pages 377–379

3. $5y + 1 = 11$
$5y + 1 - 1 = 11 - 1$
$5y = 10$
$\frac{5y}{5} = \frac{10}{5}$
$y = 2$
The solution is 2.

4. $3x + 5 = 26$
$3x + 5 - 5 = 26 - 5$
$3x = 21$
$\frac{3x}{3} = \frac{21}{3}$
$x = 7$
The solution is 7.

5. $2z - 9 = 11$
$2z - 9 + 9 = 11 + 9$
$2z = 20$
$\frac{2z}{2} = \frac{20}{2}$
$z = 10$
The solution is 10.

6. $7p - 2 = 26$
$7p - 2 + 2 = 26 + 2$
$7p = 28$
$\frac{7p}{7} = \frac{28}{7}$
$p = 4$
The solution is 4.

7. $12 = 2 + 5a$
$12 - 2 = 2 - 2 + 5a$
$10 = 5a$
$\frac{10}{5} = \frac{5a}{5}$
$2 = a$
The solution is 2.

8. $29 = 1 + 7v$
$29 - 1 = 1 - 1 + 7v$
$28 = 7v$
$\frac{28}{7} = \frac{7v}{7}$
$4 = v$
The solution is 4.

9. $-5y + 8 = 13$
$-5y + 8 - 8 = 13 - 8$
$-5y = 5$
$\frac{-5y}{-5} = \frac{5}{-5}$
$y = -1$
The solution is –1.

10. $-7p + 6 = -8$
$-7p + 6 - 6 = -8 - 6$
$-7p = -14$
$\frac{-7p}{-7} = \frac{-14}{-7}$
$p = 2$
The solution is 2.

11. $-12a - 1 = 23$
$-12a - 1 + 1 = 23 + 1$
$-12a = 24$
$\frac{-12a}{-12} = \frac{24}{-12}$
$a = -2$
The solution is –2.

12. $-15y - 7 = 38$
$-15y - 7 + 7 = 38 + 7$
$-15y = 45$
$\frac{-15y}{-15} = \frac{45}{-15}$
The solution is –3.

13. $10 - c = 14$
$10 - 10 - c = 14 - 10$
$-c = 4$
$\frac{-1c}{-1} = \frac{4}{-1}$
$c = -4$
The solution is –4.

14. $3 - x = 1$
$3 - 3 - x = 1 - 3$
$-x = -2$
$\frac{-1x}{-1} = \frac{-2}{-1}$
$x = 2$
The solution is 2.

15. $4 - 3x = -5$
$4 - 4 - 3x = -5 - 4$
$-3x = -9$
$\frac{-3x}{-3} = \frac{-9}{-3}$
$x = 3$
The solution is 3.

16. $8 - 5x = -12$
$8 - 8 - 5x = -12 - 8$
$-5x = -20$
$\frac{-5x}{-5} = \frac{-20}{-5}$
$x = 4$
The solution is 4.

17. $-33 = 3 - 4z$
$-33 - 3 = 3 - 3 - 4z$
$-36 = -4z$
$\frac{-36}{-4} = \frac{-4z}{-4}$
$9 = z$
The solution is 9.

18. $-41 = 7 - 8v$
$-41 - 7 = 7 - 7 - 8v$
$-48 = -8v$
$\frac{-48}{-8} = \frac{-8v}{-8}$
$6 = v$
The solution is 6.

19. $-4t + 16 = 0$
$-4t + 16 - 16 = 0 - 16$
$-4t = -16$
$\frac{-4t}{-4} = \frac{-16}{-4}$
$t = 4$
The solution is 4.

20. $-6p - 72 = 0$
$-6p - 72 + 72 = 0 + 72$
$-6p = 72$
$\frac{-6p}{-6} = \frac{72}{-6}$
$p = -12$
The solution is -12.

21. $5a + 9 = 12$
$5a + 9 - 9 = 12 - 9$
$5a = 3$
$\frac{5a}{5} = \frac{3}{5}$
$a = \frac{3}{5}$
The solution is $\frac{3}{5}$.

22. $7c + 5 = 20$
$7c + 5 - 5 = 20 - 5$
$7c = 15$
$\frac{7c}{7} = \frac{15}{7}$
$c = \frac{15}{7}$
The solution is $\frac{15}{7}$.

23. $2t - 5 = 2$
$2t - 5 + 5 = 2 + 5$
$2t = 7$
$\frac{2t}{2} = \frac{7}{2}$
$t = \frac{7}{2}$
The solution is $\frac{7}{2}$.

24. $3v - 1 = 4$
$3v - 1 + 1 = 4 + 1$
$3v = 5$
$\frac{3v}{3} = \frac{5}{3}$
$v = \frac{5}{3}$
The solution is $\frac{5}{3}$.

25. $8x + 1 = 7$
$8x + 1 - 1 = 7 - 1$
$8x = 6$
$\frac{8x}{8} = \frac{6}{8}$
$x = \frac{3}{4}$
The solution is $\frac{3}{4}$.

26. $6y + 5 = 8$
$6y + 5 - 5 = 8 - 5$
$6y = 3$
$\frac{6y}{6} = \frac{3}{6}$
$y = \frac{1}{2}$
The solution is $\frac{1}{2}$.

27. $4z - 5 = 1$
$4z - 5 + 5 = 1 + 5$
$4z = 6$
$\frac{4z}{4} = \frac{6}{4}$
$z = \frac{3}{2}$
The solution is $\frac{3}{2}$.

28. $8 = 5 + 6p$
$8 - 5 = 5 - 5 + 6p$
$3 = 6p$
$\frac{3}{6} = \frac{6p}{6}$
$\frac{1}{2} = p$
The solution is $\frac{1}{2}$.

29. $25 = 11 + 8v$
$25 - 11 = 11 - 11 + 8v$
$14 = 8v$
$\frac{14}{8} = \frac{8v}{8}$
$\frac{7}{4} = v$
The solution is $\frac{7}{4}$.

30. $-4 = 11 + 6z$
$-4 - 11 = 11 - 11 + 6z$
$-15 = 6z$
$\frac{-15}{6} = \frac{6z}{6}$
$-\frac{5}{2} = z$
The solution is $-\frac{5}{2}$.

31. $-3 = 7 + 4y$
$-3 - 7 = 7 - 7 + 4y$
$-10 = 4y$
$\frac{-10}{4} = \frac{4y}{4}$
$-\frac{5}{2} = y$
The solution is $-\frac{5}{2}$.

32. $9w - 4 = 17$
$9w - 4 + 4 = 17 + 4$
$9w = 21$
$\frac{9w}{9} = \frac{21}{9}$
$w = \frac{7}{3}$
The solution is $\frac{7}{3}$.

33. $8a - 5 = 31$
$8a - 5 + 5 = 31 + 5$
$8a = 36$
$\frac{8a}{8} = \frac{36}{8}$
$a = \frac{9}{2}$
The solution is $\frac{9}{2}$.

34. $5 - 8x = 5$
$5 - 5 - 8x = 5 - 5$
$-8x = 0$
$\frac{-8x}{-8} = \frac{0}{-8}$
$x = 0$
The solution is 0.

35. $7 - 12y = 7$
$7 - 7 - 12y = 7 - 7$
$-12y = 0$
$\frac{-12y}{-12} = \frac{0}{-12}$
$y = 0$
The solution is 0.

36. $-3 - 8z = 11$
$-3 + 3 - 8z = 11 + 3$
$-8z = 14$
$\frac{-8z}{-8} = \frac{14}{-8}$
$z = -\frac{7}{4}$
The solution is $-\frac{7}{4}$.

37. $-9 - 12y = 5$
$-9 + 9 - 12y = 5 + 9$
$-12y = 14$
$\frac{-12y}{-12} = \frac{14}{-12}$
$y = -\frac{7}{6}$.

38. $5n - \frac{2}{9} = \frac{43}{9}$
$5n - \frac{2}{9} + \frac{2}{9} = \frac{43}{9} + \frac{2}{9}$
$5n = \frac{45}{9}$
$5n = 5$
$\frac{5n}{5} = \frac{5}{5}$
$n = 1$
The solution is 1.

39. $6z - \frac{1}{3} = \frac{5}{3}$
$6z - \frac{1}{3} + \frac{1}{3} = \frac{5}{3} + \frac{1}{3}$
$6z = \frac{6}{3}$
$6z = 2$
$\frac{6z}{6} = \frac{2}{6}$
$z = \frac{1}{3}$
The solution is $\frac{1}{3}$.

40. $7y-\frac{2}{5}=\frac{12}{5}$
$7y-\frac{2}{5}+\frac{2}{5}=\frac{12}{5}+\frac{2}{5}$
$7y=\frac{14}{5}$
$\frac{1}{7}\cdot 7y=\frac{1}{7}\cdot\frac{14}{5}$
$y=\frac{2}{5}$
The solution is $\frac{2}{5}$.

41. $3p-\frac{5}{8}=\frac{19}{8}$
$3p-\frac{5}{8}+\frac{5}{8}=\frac{19}{8}+\frac{5}{8}$
$3p=\frac{24}{8}$
$3p=3$
$\frac{3p}{3}=\frac{3}{3}$
$p=1$
The solution is 1.

42. $\frac{3}{4}x-1=2$
$\frac{3}{4}x-1+1=2+1$
$\frac{3}{4}x=3$
$\frac{4}{3}\left(\frac{3}{4}x\right)=\frac{4}{3}\cdot 3$
$x=4$
The solution is 4.

43. $\frac{4}{5}y+3=11$
$\frac{4}{5}y+3-3=11-3$
$\frac{4}{5}y=8$
$\frac{5}{4}\left(\frac{4}{5}y\right)=\frac{5}{4}\cdot 8$
$y=10$
The solution is 10.

44. $\frac{5t}{6}+4=-1$
$\frac{5t}{6}+4-4=-1-4$
$\frac{5}{6}t=-5$
$\frac{6}{5}\left(\frac{5}{6}t\right)=\frac{6}{5}(-5)$
$t=-6$
The solution is –6.

45. $\frac{3v}{7}-2=10$
$\frac{3v}{7}-2+2=10+2$
$\frac{3}{7}v=12$
$\frac{7}{3}\left(\frac{3}{7}v\right)=\frac{7}{3}\cdot 12$
$v=28$
The solution is 28.

46. $\frac{2a}{5}-5=7$
$\frac{2a}{5}-5+5=7+5$
$\frac{2a}{5}=12$
$\frac{5}{2}\left(\frac{2}{5}a\right)=\frac{5}{2}\cdot 12$
$a=30$
The solution is 30.

47. $\frac{4z}{9}+23=3$
$\frac{4z}{9}+23-23=3-23$
$\frac{4z}{9}=-20$
$\frac{9}{4}\left(\frac{4}{9}z\right)=\frac{9}{4}(-20)$
$z=-45$
The solution is –45.

48. $\frac{x}{3}+6=1$
$\frac{x}{3}+6-6=1-6$
$\frac{x}{3}=-5$
$\frac{3}{1}\left(\frac{1}{3}x\right)=\frac{3}{1}(-5)$
$x=-15$
The solution is –15.

49. $\frac{y}{4}+5=2$
$\frac{y}{4}+5-5=2-5$
$\frac{y}{4}=-3$
$\frac{4}{1}\left(\frac{1}{4}y\right)=\frac{4}{1}(-3)$
$y=-12$
The solution is –12.

50. $17 = 20 + \frac{3}{4}x$

$17 - 20 = 20 - 20 + \frac{3}{4}x$

$-3 = \frac{3}{4}x$

$\frac{4}{3}(-3) = \frac{4}{3}\left(\frac{3}{4}x\right)$

$-4 = x$

The solution is –4.

51. $\frac{2}{5}y - 3 = 1$

$\frac{2}{5}y - 3 + 3 = 1 + 3$

$\frac{2}{5}y = 4$

$\frac{5}{2}\left(\frac{2}{5}y\right) = \frac{5}{2}(4)$

$y = 10$

The solution is 10.

52. $\frac{7}{3}v + 2 = 8$

$\frac{7}{3}v + 2 - 2 = 8 - 2$

$\frac{7}{3}v = 6$

$\frac{3}{7}\left(\frac{7}{3}v\right) = \frac{3}{7} \cdot 6$

$v = \frac{18}{7}$

The solution is $\frac{18}{7}$.

53. $5 - \frac{7}{8}y = 2$

$5 - 5 - \frac{7}{8}y = 2 - 5$

$-\frac{7}{8}y = -3$

$\left(-\frac{8}{7}\right)\left(-\frac{7}{8}y\right) = \left(-\frac{8}{7}\right)(-3)$

$y = \frac{24}{7}$

The solution is $\frac{24}{7}$.

54. $3 - \frac{5}{2}z = 6$

$3 - 3 - \frac{5}{2}z = 6 - 3$

$-\frac{5}{2}z = 3$

$\left(-\frac{2}{5}\right)\left(-\frac{5}{2}z\right) = \left(-\frac{2}{5}\right)(3)$

$z = -\frac{6}{5}$

The solution is $-\frac{6}{5}$.

55. $\frac{3}{5}y + \frac{1}{4} = \frac{3}{4}$

$\frac{3}{5}y + \frac{1}{4} - \frac{1}{4} = \frac{3}{4} - \frac{1}{4}$

$\frac{3}{5}y = \frac{1}{2}$

$\frac{5}{3}\left(\frac{3}{5}y\right) = \frac{5}{3}\left(\frac{1}{2}\right)$

$y = \frac{5}{6}$

The solution is $\frac{5}{6}$.

56. $\frac{5}{6}x - \frac{2}{3} = \frac{5}{3}$

$\frac{5}{6}x - \frac{2}{3} + \frac{2}{3} = \frac{5}{3} + \frac{2}{3}$

$\frac{5}{6}x = \frac{7}{3}$

$\frac{6}{5}\left(\frac{5}{6}\right)x = \frac{6}{5}\left(\frac{7}{3}\right)$

$x = \frac{14}{5}$

The solution is $\frac{14}{5}$.

57. $\frac{3}{5} = \frac{2}{7}t + \frac{1}{5}$

$\frac{3}{5} - \frac{1}{5} = \frac{2}{7}t + \frac{1}{5} - \frac{1}{5}$

$\frac{2}{5} = \frac{2}{7}t$

$\frac{7}{2}\left(\frac{2}{5}\right) = \frac{7}{2}\left(\frac{2}{7}t\right)$

$\frac{7}{5} = t$

The solution is $\frac{7}{5}$.

58. $\frac{10}{3} = \frac{9}{5}w - \frac{2}{3}$

$\frac{10}{3} + \frac{2}{3} = \frac{9}{5}w - \frac{2}{3} + \frac{2}{3}$

$\frac{12}{3} = \frac{9}{5}w$

$4 = \frac{9}{5}w$

$\frac{5}{9}(4) = \frac{5}{9}\left(\frac{9}{5}w\right)$

$\frac{20}{9} = w$

The solution is $\frac{20}{9}$.

59. $\frac{z}{3}-\frac{1}{2}=\frac{1}{4}$
$\frac{z}{3}-\frac{1}{2}+\frac{1}{2}=\frac{1}{4}+\frac{1}{2}$
$\frac{z}{3}=\frac{1}{4}+\frac{2}{4}$
$\frac{z}{3}=\frac{3}{4}$
$\frac{3}{1}\left(\frac{1}{3}z\right)=\frac{3}{1}\left(\frac{3}{4}\right)$
$z=\frac{9}{4}$
The solution is $\frac{9}{4}$.

60. $\frac{a}{6}+\frac{1}{4}=\frac{3}{8}$
$\frac{a}{6}+\frac{1}{4}-\frac{1}{4}=\frac{3}{8}-\frac{1}{4}$
$\frac{a}{6}=\frac{3}{8}-\frac{2}{8}$
$\frac{a}{6}=\frac{1}{8}$
$\frac{6}{1}\left(\frac{1}{6}a\right)=\frac{6}{1}\left(\frac{1}{8}\right)$
$a=\frac{3}{4}$
The solution is $\frac{3}{4}$.

61. $5.6t-5.1=1.06$
$5.6t-5.1+5.1=1.06+5.1$
$5.6t=6.16$
$\frac{5.6t}{5.6}=\frac{6.16}{5.6}$
$t=1.1$
The solution is 1.1.

62. $7.2+5.2z=8.76$
$7.2-7.2+5.2z=8.76-7.2$
$5.2z=1.56$
$\frac{5.2z}{5.2}=\frac{1.56}{5.2}$
$z=0.3$
The solution is 0.3.

63. $6.2-3.3t=-12.94$
$6.2-6.2-3.3t=-12.94-6.2$
$-3.3t=-19.14$
$\frac{-3.3t}{-3.3}=\frac{-19.14}{-3.3}$
$t=5.8$
The solution is 5.8.

64. $2.4-4.8v=13.92$
$2.4-2.4-4.8v=13.92-2.4$
$-4.8v=11.52$
$\frac{-4.8v}{-4.8}=\frac{11.52}{-4.8}$
$v=-2.4$
The solution is –2.4.

65. $6c-2-3c=10$
$3c-2=10$
$3c-2+2=10+2$
$3c=12$
$\frac{3c}{3}=\frac{12}{3}$
$c=4$
The solution is 4.

66. $12t+6+3t=16$
$15t+6=16$
$15t+6-6=16-6$
$15t=10$
$\frac{15t}{15}=\frac{10}{15}$
$t=\frac{2}{3}$
The solution is $\frac{2}{3}$.

67. $4y+5-12y=-3$
$-8y+5=-3$
$-8y+5-5=-3-5$
$-8y=-8$
$\frac{-8y}{-8}=\frac{-8}{-8}$
$y=1$
The solution is 1.

68. $7m-15-10m=6$
$-3m-15=6$
$-3m-15+15=6+15$
$-3m=21$
$\frac{-3m}{-3}=\frac{21}{-3}$
The solution is –7.

69. $17=12p-5-6p$
$17=6p-5$
$17+5=6p-5+5$
$22=6p$
$\frac{22}{6}=\frac{6p}{6}$
$\frac{11}{3}=p$
The solution is $\frac{11}{3}$.

70. $29 = 4x + 5 - 9x$

$29 = -5x + 5$

$29 - 5 = -5x + 5 - 5$

$24 = -5x$

$\frac{24}{-5} = \frac{-5x}{-5}$

$-\frac{24}{5} = x$

The solution is $-\frac{24}{5}$.

71. $3 = 6n + 23 - 10n$

$3 = -4n + 23$

$3 - 23 = -4n + 23 - 23$

$-20 = -4n$

$\frac{-20}{-4} = \frac{-4n}{-4}$

$5 = n$

The solution is 5.

Objective B Exercises, pages 379–380

72. Strategy: To find the number of years, substitute 48,000 for V and 70,000 for C in the given equation and solve for t.

Solution:

$V = C - 5{,}500t$

$48{,}000 = 70{,}000 - 5{,}500t$

$48{,}000 - 70{,}000 = 70{,}000 - 70{,}000 - 5{,}500t$

$-22{,}000 = -5{,}500t$

$\frac{-22{,}000}{-5{,}500} = \frac{-5{,}500t}{-5{,}500}$

$4 = t$

In 4 years, the x-ray machine will have a value of $48,000.

73. Strategy: To find the number of years, substitute 47,500 for V and 63,000 for C in the given equation and solve for t.

Solution:

$V = C - 5{,}500t$

$47{,}500 = 63{,}000 - 5{,}500t$

$47{,}500 - 63{,}000 = 63{,}000 - 63{,}000 - 5{,}500t$

$-15{,}500 = -5{,}500t$

$\frac{-15{,}500}{-5{,}500} = \frac{-5{,}500t}{-5{,}500}$

$2.818 \approx t$

In approximately 2.8 years, the x-ray machine will have a value of $47,500.

74. Strategy: To find the maximum loan amount you can afford, substitute 300 for P in the given formula and solve for L.

Solution:

$P = 0.02076L$

$300 = 0.02076L$

$\frac{300}{0.02076} = \frac{0.02076L}{0.02076}$

$14{,}450.87 \approx L$

The maximum loan amount you can afford is $14,450.87.

75. Strategy To find the maximum loan amount you can afford, substitute 325 for P in the given formula and solve for L.

Solution
$P = 0.02076L$
$325 = 0.02076L$
$\frac{325}{0.02076} = \frac{0.02076L}{0.02076}$
$15{,}655.11 \approx L$
The maximum loan amount you can afford is $15,655.11.

76. Strategy To find the year, substitute 4 for t in the given equation and solve for y.

Solution
$t = 17.08 - 0.0067y$
$4 = 17.08 - 0.0067y$
$4 - 17.08 = 17.08 - 17.08 - 0.0067y$
$-13.08 = -0.0067y$
$\frac{-13.08}{-0.0067} = \frac{-0.0067y}{-0.0067}$
$1952 \approx y$
The 4-minute mile was predicted in 1952.

77. Strategy To find the year, substitute 3.77 for t in the given equation and solve for y.

Solution
$t = 17.08 - 0.0067y$
$3.77 = 17.08 - 0.0067y$
$3.77 - 17.08 = 17.08 - 17.08 - 0.0067y$
$-13.31 = 0.0067y$
$\frac{-13.31}{-0.0067} = \frac{-0.0067y}{-0.0067}$
$1986.567 \approx y$
The 3.77-minute mile was predicted for 1987.

78. Strategy To find the distance, substitute -3 for C in the given equation and solve for D.

Solution
$C = \frac{1}{4}D - 45$
$-3 = \frac{1}{4}D - 45$
$-3 + 45 = \frac{1}{4}D - 45 + 45$
$42 = \frac{1}{4}D$
$\frac{4}{1}(42) = \frac{4}{1}\left(\frac{1}{4}D\right)$
$168 = D$
The car will slide 168 ft.

79. Strategy To find the distance, substitute –11 for C in the given equation and solve for D.

Solution
$$C = \frac{1}{4}D - 45$$
$$-11 = \frac{1}{4}D - 45$$
$$-11 + 45 = \frac{1}{4}D - 45 + 45$$
$$34 = \frac{1}{4}D$$
$$\frac{4}{1}(34) = \frac{4}{1}\left(\frac{1}{4}D\right)$$
$$136 = D$$
The car sill slide 136 ft.

Critical Thinking 6.2, page 380

80. Recall that for a division problem:
Dividend = Divisor · Quotient + Remainder
For $x \div 28 = 1{,}481$, the remainder is 25, the dividend is x, the divisor is 28, and the quotient is 1,481. Thus
$$x = 28 \cdot 1{,}481 + 25$$
$$x = 41{,}468 + 25$$
$$x = 41{,}493$$

81. Answers will vary.
$x = -3$. Let $a = 2$ and $b = 5$, and solve for c.
$$ax + b = c$$
$$2(-3) + 5 = c$$
$$-6 + 5 = c$$
$$-1 = c$$
Thus the equation $2x + 5 = -1$ has a solution of –3.

80.
$$ax + b = c$$
$$ax - b = c - b$$
$$ax = c - b$$
$$\frac{ax}{a} = \frac{c-b}{a}$$
$$x = \frac{c-b}{a},\ a \neq 0$$
This equation will have a solution for all real numbers a, b, and c except for $a = 0$. If $a = 0$, then we have division by zero which is not defined.

81. The expression "Solve $2x - 3(4x + 1)$" has no meaning because there is no equal sign.

Section 6.3

Objective A Exercises, pages 385–386

1.
$$4x + 3 = 2x + 9$$
$$4x - 2x + 3 = 2x - 2x + 9$$
$$2x + 3 = 9$$
$$2x + 3 - 3 = 9 - 3$$
$$2x = 6$$
$$\frac{2x}{2} = \frac{6}{2}$$
$$x = 3$$
The solution is 3.

2. $6z + 5 = 3z + 20$
$6z - 3z + 5 = 3z - 3z + 20$
$3z + 5 = 20$
$3z + 5 - 5 = 20 - 5$
$3z = 15$
$\frac{3z}{3} = \frac{15}{3}$
$z = 5$
The solution is 5.

3. $7y - 6 = 3y + 6$
$7y - 3y - 6 = 3y - 3y + 6$
$4y - 6 = 6$
$4y - 6 + 6 = 6 + 6$
$4y = 12$
$\frac{4y}{4} = \frac{12}{4}$
$y = 3$
The solution is 3.

4. $8w - 5 = 5w + 10$
$8w - 5w - 5 = 5w - 5w + 10$
$3w - 5 = 10$
$3w - 5 + 5 = 10 + 5$
$3w = 15$
$\frac{3w}{3} = \frac{15}{3}$
$w = 5$
The solution is 5.

5. $12m + 11 = 5m + 4$
$12m - 5m + 11 = 5m - 5m + 4$
$7m + 11 = 4$
$7m + 11 - 11 = 4 - 11$
$7m = -7$
$\frac{7m}{7} = \frac{-7}{7}$
$m = -1$
The solution is –1.

6. $8a + 9 = 2a - 9$
$8a - 2a + 9 = 2a - 2a - 9$
$6a + 9 = -9$
$6a + 9 - 9 = -9 - 9$
$6a = -18$
$\frac{6a}{6} = \frac{-18}{6}$
$a = -3$
The solution is –3.

7. $7c - 5 = 2c - 25$
$7c - 2c - 5 = 2c - 2c - 25$
$5c - 5 = -25$
$5c - 5 + 5 = -25 + 5$
$5c = -20$
$\frac{5c}{5} = \frac{-20}{5}$
$c = -4$
The solution is –4.

8. $7r - 1 = 5r - 13$
$7r - 5r - 1 = 5r - 5r - 13$
$2r - 1 = -13$
$2r - 1 + 1 = -13 + 1$
$2r = -12$
$\frac{2r}{2} = \frac{-12}{2}$
$r = -6$
The solution is –6.

9. $2n - 3 = 5n - 18$
$2n - 5n - 3 = 5n - 5n - 18$
$-3n - 3 = -18$
$-3n - 3 + 3 = -18 + 3$
$-3n = -15$
$\frac{-3n}{-3} = \frac{-15}{-3}$
$n = 5$
The solution is 5.

10. $4t - 7 = 10t - 25$
$4t - 10t - 7 = 10t - 10t - 25$
$-6t - 7 = -25$
$-6t - 7 + 7 = -25 + 7$
$-6t = -18$
$\frac{-6t}{-6} = \frac{-18}{-6}$
$t = 3$
The solution is 3.

11. $3z + 5 = 19 - 4z$
$3z + 4z + 5 = 19 - 4z + 4z$
$7z + 5 = 19$
$7z + 5 - 5 = 19 - 5$
$7z = 14$
$\frac{7z}{7} = \frac{14}{7}$
$z = 2$
The solution is 2.

12. $2m + 3 = 23 - 8m$
$2m + 8m + 3 = 23 - 8m + 8m$
$10m + 3 = 23$
$10m + 3 - 3 = 23 - 3$
$10m = 20$
$\frac{10m}{10} = \frac{20}{10}$
$m = 2$
The solution is 2.

13. $5v - 3 = 4 - 2v$
$5v + 2v - 3 = 4 - 2v + 2v$
$7v - 3 = 4$
$7v - 3 + 3 = 4 + 3$
$7v = 7$
$\frac{7v}{7} = \frac{7}{7}$
$v = 1$
The solution is 1.

14. $3r - 8 = 2 - 2r$
$3r + 2r - 8 = 2 - 2r + 2r$
$5r - 8 = 2$
$5r - 8 + 8 = 2 + 8$
$5r = 10$
$\frac{5r}{5} = \frac{10}{5}$
$r = 2$
The solution is 2.

15. $7 - 4a = 2a$
$7 - 4a + 4a = 2a + 4a$
$7 = 6a$
$\frac{7}{6} = \frac{6a}{6}$
$\frac{7}{6} = a$
The solution is $\frac{7}{6}$.

16. $5 - 3x = 5x$
$5 - 3x + 3x = 5x + 3x$
$5 = 8x$
$\frac{5}{8} = \frac{8x}{8}$
$\frac{5}{8} = x$
The solution is $\frac{5}{8}$.

17. $12 - 5y = 3y - 12$
$12 - 5y - 3y = 3y - 3y - 12$
$12 - 8y = -12$
$12 - 12 - 8y = -12 - 12$
$-8y = -24$
$\frac{-8y}{-8} = \frac{-24}{-8}$
$y = 3$
The solution is 3.

18. $8 - 3m = 8m - 14$
$8 - 3m - 8m = 8m - 8m - 14$
$8 - 11m = -14$
$8 - 8 - 11m = -14 - 8$
$-11m = -22$
$\frac{-11m}{-11} = \frac{-22}{-11}$
$m = 2$
The solution is 2.

19. $7r = 8 + 2r$
$7r - 2r = 8 + 2r - 2r$
$5r = 8$
$\frac{5r}{5} = \frac{8}{5}$
$r = \frac{8}{5}$
The solution is $\frac{8}{5}$.

20. $-2w = 4 - 5w$
$-2w + 5w = 4 - 5w + 5w$
$3w = 4$
$\frac{3w}{3} = \frac{4}{3}$
$w = \frac{4}{3}$
The solution is $\frac{4}{3}$.

21. $5a + 3 = 3a + 10$
$5a - 3a + 3 = 3a - 3a + 10$
$2a + 3 = 10$
$2a + 3 - 3 = 10 - 3$
$2a = 7$
$\frac{2a}{2} = \frac{7}{2}$
The solution is $\frac{7}{2}$.

22. $7y + 3 = 5y + 12$
$7y - 5y + 3 = 5y - 5y + 12$
$2y + 3 = 12$
$2y + 3 - 3 = 12 - 3$
$2y = 9$
$\frac{2y}{2} = \frac{9}{2}$
$y = \frac{9}{2}$
The solution is $\frac{9}{2}$.

23. $9w - 2 = 5w + 4$
$9w - 5w - 2 = 5w - 5w + 4$
$4w - 2 = 4$
$4w - 2 + 2 = 4 + 2$
$4w = 6$
$\frac{4w}{4} = \frac{6}{4}$
$w = \frac{3}{2}$.
The solution is $\frac{3}{2}$.

24. $7n - 3 = 3n + 6$
$7n - 3n - 3 = 3n - 3n + 6$
$4n - 3 = 6$
$4n - 3 + 3 = 6 + 3$
$4n = 9$
$\frac{4n}{4} = \frac{9}{4}$
$n = \frac{9}{4}$.
The solution is $\frac{9}{4}$.

25. $x - 7 = 5x - 21$
$x - 5x - 7 = 5x - 5x - 21$
$-4x - 7 = -21$
$-4x - 7 + 7 = -21 + 7$
$-4x = -14$
$\frac{-4x}{-4} = \frac{-14}{-4}$
$x = \frac{7}{2}$
The solution is $\frac{7}{2}$.

26. $3y - 4 = 9y - 24$
$3y - 9y - 4 = 9y - 9y - 24$
$-6y - 4 = -24$
$-6y - 4 + 4 = -24 + 4$
$-6y = -20$
$\frac{-6y}{-6} = \frac{-20}{-6}$
$y = \frac{10}{3}$
The solution is $\frac{10}{3}$.

27. $5n - 1 + 2n = 4n + 8$
$7n - 1 = 4n + 8$
$7n - 4n - 1 = 4n - 4n + 8$
$3n - 1 = 8$
$3n - 1 + 1 = 8 + 1$
$3n = 9$
$\frac{3n}{3} = \frac{9}{3}$
$n = 3$
The solution is 3.

28. $3y + 1 + y = 2y + 11$
$4y + 1 = 2y + 11$
$4y - 2y + 1 = 2y - 2y + 11$
$2y + 1 = 11$
$2y + 1 - 1 = 11 - 1$
$2y = 10$
$\frac{2y}{2} = \frac{10}{2}$
$y = 5$
The solution is 5.

29. $3z - 2 - 7z = 4z + 6$
$-4z - 2 = 4z + 6$
$-4z - 4z - 2 = 4z - 4z + 6$
$-8z - 2 = 6$
$-8z - 2 + 2 = 6 + 2$
$-8z = 8$
$\frac{-8z}{-8} = \frac{8}{-8}$
$z = -1$
The solution is –1.

30. $2a + 3 - 9a = 3a + 33$
$-7a + 3 = 3a + 33$
$-7a - 3a + 3 = 3a - 3a + 33$
$-10a + 3 = 33$
$-10a + 3 - 3 = 33 - 3$
$-10a = 30$
$\frac{-10a}{-10} = \frac{30}{-10}$
$a = -3$
The solution is –3.

31. $4t - 8 + 12t = 3 - 4t - 11$
$16t - 8 = -8 - 4t$
$16t + 4t - 8 = -8 - 4t + 4t$
$20t - 8 = -8$
$20t - 8 + 8 = -8 + 8$
$20t = 0$
$\frac{20t}{20} = \frac{0}{20}$
$t = 0$
The solution is 0.

32. $6x - 5 + 9x = 7 - 4x - 12$
$15x - 5 = -4x - 5$
$15x + 4x - 5 = -4x + 4x - 5$
$19x - 5 = -5$
$19x - 5 + 5 = -5 + 5$
$19x = 0$
$\frac{19x}{19} = \frac{0}{19}$
The solution is 0.

Objective B Exercises, pages 386–387

33. $3(4y + 5) = 25$
$12y + 15 = 25$
$12y + 15 - 15 = 25 - 15$
$12y = 10$
$\frac{12y}{12} = \frac{10}{12}$
$y = \frac{5}{6}$
The solution is $\frac{5}{6}$.

34. $5(3z - 2) = 8$
$15z - 10 = 8$
$15z - 10 + 10 = 8 + 10$
$15z = 18$
$\frac{15z}{15} = \frac{18}{15}$
$z = \frac{6}{5}$
The solution is $\frac{6}{5}$.

35. $-2(4x + 1) = 22$
$-8x - 2 = 22$
$-8x - 2 + 2 = 22 + 2$
$-8x = 24$
$\frac{-8x}{-8} = \frac{24}{-8}$
$x = -3$
The solution is -3.

36. $-3(2x - 5) = 30$
$-6x + 15 = 30$
$-6x + 15 - 15 = 30 - 15$
$-6x = 15$
$\frac{-6x}{-6} = \frac{15}{-6}$
$x = -\frac{5}{2}$
The solution is $-\frac{5}{2}$.

37. $5(2k + 1) - 7 = 28$
$10k + 5 - 7 = 28$
$10k - 2 = 28$
$10k - 2 + 2 = 28 + 2$
$10k = 30$
$\frac{10k}{10} = \frac{30}{10}$
$k = 3$
The solution is 3.

38. $7(3t - 4) + 8 = -6$
$21t - 28 + 8 = -6$
$21t - 20 = -6$
$21t - 20 + 20 = -6 + 20$
$21t = 14$
$\frac{21t}{21} = \frac{14}{21}$
$t = \frac{2}{3}$
The solution is $\frac{2}{3}$.

39. $3(3v - 4) + 2v = 10$
$9v - 12 + 2v = 10$
$11v - 12 = 10$
$11v - 12 + 12 = 10 + 12$
$11v = 22$
$\frac{11v}{11} = \frac{22}{11}$
$v = 2$
The solution is 2.

40. $4(3x + 1) - 5x = 25$
$12x + 4 - 5x = 25$
$7x + 4 = 25$
$7x + 4 - 4 = 25 - 4$
$7x = 21$
$\frac{7x}{7} = \frac{21}{7}$
$x = 3$
The solution is 3.

41. $3y + 2(y + 1) = 12$
$3y + 2y + 2 = 12$
$5y + 2 = 12$
$5y + 2 - 2 = 12 - 2$
$5y = 10$
$\frac{5y}{5} = \frac{10}{5}$
$y = 2$
The solution is 2.

42. $7x + 3(x + 2) = 33$
$7x + 3x + 6 = 33$
$10x + 6 = 33$
$10x + 6 - 6 = 33 - 6$
$10x = 27$
$\frac{10x}{10} = \frac{27}{10}$
$x = \frac{27}{10}$
the solution is $\frac{27}{10}$.

43. $7v - 3(v - 4) = 20$
$7v - 3v + 12 = 20$
$4v + 12 = 20$
$4v + 12 - 12 = 20 - 12$
$4v = 8$
$\frac{4v}{4} = \frac{8}{4}$
$v = 2$
The solution is 2.

44. $15m - 4(2m - 5) = 34$
$15m - 8m + 20 = 34$
$7m + 20 = 34$
$7m + 20 - 20 = 34 - 20$
$7m = 14$
$\frac{7m}{7} = \frac{14}{7}$
$m = 2$
The solution is 2.

45. $6 + 3(3x - 3) = 24$
$6 + 9x - 9 = 24$
$9x - 3 = 24$
$9x - 3 + 3 = 24 + 3$
$9x = 27$
$\frac{9x}{9} = \frac{27}{9}$
$x = 3$
The solution is 3.

46. $9 + 2(4p - 3) = 24$
$9 + 8p - 6 = 24$
$8p + 3 = 24$
$8p + 3 - 3 = 24 - 3$
$8p = 21$
$\frac{8p}{8} = \frac{21}{8}$
$p = \frac{21}{8}$
The solution is $\frac{21}{8}$.

47. $9 - 3(4a - 2) = 9$
$9 - 12a + 6 = 9$
$-12a + 15 = 9$
$-12a + 15 - 15 = 9 - 15$
$-12a = -6$
$\frac{-12a}{-12} = \frac{-6}{-12}$
$a = \frac{1}{2}$
The solution is $\frac{1}{2}$.

48. $17 - 8(x - 3) = 1$
$17 - 8x + 24 = 1$
$-8x + 41 = 1$
$-8x + 41 - 41 = 1 - 41$
$-8x = -40$
$\frac{-8x}{-8} = \frac{-40}{-8}$
$x = 5$
The solution is 5.

49. $3(2z - 5) = 4z + 1$
$6z - 15 = 4z + 1$
$6z - 4z - 15 = 4z - 4z + 1$
$2z - 15 = 1$
$2z - 15 + 15 = 1 + 15$
$2z = 16$
$\frac{2z}{2} = \frac{16}{2}$
$z = 8$
The solution is 8.

50. $4(3z - 1) = 5z + 17$
$12z - 4 = 5z + 17$
$12z - 5z - 4 = 5z - 5z + 17$
$7z - 4 = 17$
$7z - 4 + 4 = 17 + 4$
$7z = 21$
$\frac{7z}{7} = \frac{21}{7}$
$z = 3$
The solution is 3.

51. $2-3(5x+2)=2(3-5x)$
$2-15x-6=6-10x$
$-15x-4=6-10x$
$-15x+10x-4=6-10x+10x$
$-5x-4=6$
$-5x-4+4=6+4$
$-5x=10$
$\frac{-5x}{-5}=\frac{10}{-5}$
$x=-2$
The solution is –2.

52. $5-2(3y+1)=3(2-3y)$
$5-6y-2=6-9y$
$-6y+3=6-9y$
$-6y+9y+3=6-9y+9y$
$3y+3=6$
$3y+3-3=6-3$
$3y=3$
$\frac{3y}{3}=\frac{3}{3}$
$y=1$
The solution is 1.

53. $4r+11=5-2(3r+3)$
$4r+11=5-6r-6$
$4r+11=-6r-1$
$4r+6r+11=-6r+6r-1$
$10r+11=-1$
$10r+11-11=-1-11$
$10r=-12$
$\frac{10r}{10}=\frac{-12}{10}$
$r=-\frac{6}{5}$
The solution is $-\frac{6}{5}$.

54. $3v+6=9-4(2v-2)$
$3v+6=9-8v+8$
$3v+6=17-8v$
$3v+8v+6=17-8v+8v$
$11v+6=17$
$11v+6-6=17-6$
$11v=11$
$\frac{11v}{11}=\frac{11}{11}$
$v=1$
The solution is 1.

55. $7n-2=5-(9-n)$
$7n-2=5-9+n$
$7n-2=-4+n$
$7n-n-2=-4+n-n$
$6n-2=-4$
$6n-2+2=-4+2$
$6n=-2$
$\frac{6n}{6}=\frac{-2}{6}$
$n=-\frac{1}{3}$
The solution is $-\frac{1}{3}$.

56. $8x-5=7-2(5-x)$
$8x-5=7-10+2x$
$8x-5=-3+2x$
$8x-2x-5=-3+2x-2x$
$6x-5=-3$
$6x-5+5=-3+5$
$6x=2$
$\frac{6x}{6}=\frac{2}{6}$
$x=\frac{1}{3}$
The solution is $\frac{1}{3}$.

Objective C Exercises, pages 387–388

57. Strategy

The distance of the fulcrum from the 190-pound person: x
The distance of the fulcrum from the 120-pound person: $15-x$
To find the placement of the fulcrum, replace the variables F_1, F_2, and d by the given values and solve for x.

Solution

$F_1 \cdot x = F_2 \cdot (d-x)$
$180 \cdot x = 120(15-x)$
$180x = 1{,}800 - 120x$
$300x = 1{,}800$
$\frac{300x}{300} = \frac{1{,}800}{300}$
$x = 6$
The 180-pound person should be 6 ft from the fulcrum.

58. Strategy

The distance of the fulcrum from the 90-pound child: x
The distance of the fulcrum from the 60-pound child: $10-x$
To find the placement of the fulcrum, replace the variables F_1, F_2, and d by the given values and solve for x.

Solution

$F_1 \cdot x = F_2 \cdot (d-x)$
$90 \cdot x = 60(10-x)$
$90x = 600 - 60x$
$150x = 600$
$\frac{150x}{150} = \frac{600}{150}$
$x = 4$
The 90-pound child should be placed 4 ft from the fulcrum.

59. Strategy

To find the minimum force, substitute 150 for F_1, 8 for d, and 1.5 for x in the given equation and solve for F_2.

Solution

$F_1 \cdot x = F_2 \cdot (d-x)$
$150 \cdot 1.5 = F_2(8-1.5)$
$225 = 6.5F_2$
$\frac{225}{6.5} = \frac{6.5F_2}{6.5}$
$34.6 \approx F_2$
The minimum force is approximately 34.6 lb.

60. Strategy

To find the force, substitute 30 for F_2, 9 for d, and 0.15 for x in the given equation and solve for F_1.

Solution

$F_1 \cdot x = F_2 \cdot (d-x)$
$F_1 \cdot 0.15 = 30(9-0.15)$
$0.15F_1 = 265.5$
$\frac{0.15F_1}{0.15} = \frac{265.5}{0.15}$
$F_1 = 1{,}770$
The force on the lip of the can is 1,770 lb.

61. Strategy To find the breakeven point, substitute 1,600 for P, 950 for C, and 211,250 for F in the given equation and solve for x.

Solution
$Px = Cx + F$
$1{,}600x = 950x + 211{,}250$
$650x = 211{,}250$
$\frac{650x}{650} = \frac{211{,}250}{650}$
$x = 325$
325 units must be sold to break even.

62. Strategy To find the breakeven point, substitute 325 for P, 175 for C, and 39,000 for F in the given equation and solve for x.

Solution
$Px = Cx + F$
$325x = 175x + 39{,}000$
$150x = 39{,}000$
$\frac{150x}{150} = \frac{39{,}000}{150}$
$x = 260$
260 units must be sold to break even.

63. Strategy To find the breakeven point, substitute 99 for P, 38 for C, and 24,400 for F in the given equation and solve for x.

Solution
$Px = Cx + F$
$99x = 38x + 24{,}400$
$61x = 24{,}400$
$\frac{61x}{61} = \frac{24{,}400}{61}$
$x = 400$
400 units must be sold to break even.

64. Strategy To find the breakeven point, substitute 49 for P, 12 for C, and 19,240 for F in the given equation and solve for x.

Solution
$Px = Cx + F$
$49x = 12x + 19{,}240$
$37x = 19{,}240$
$\frac{37x}{37} = \frac{19{,}240}{37}$
$x = 520$
520 units must be sold to break even.

Critical Thinking 6.3, page 388

65. Solve for a:
$5a - 4 = 3a + 2$
$5a - 3a = 2 + 4$
$2a = 6$
$a = 3$
Substitute 3 for a in $4a^3$:
$4a^3 = 4(3^3) = 4(27) = 108$

66. Solve each equation.

$3+2(4a-3)=5$
$3+8a-6=5$
$8a-3=5$
$8a=8$
$a=1$

$4-3(2-3b)=11$
$4-6+9b=11$
$-2+9b=11$
$9b=13$
$b=\frac{13}{9}$

Because $1<\frac{13}{9}$, $a<b$.

Section 6.4

Objective A Exercises, pages 393–394

1. The unknown number: x

$\boxed{\text{The sum of a number and twelve}}$ is $\boxed{\text{twenty}}$

$x+12=20$
$x+12-12=20-12$
$x=8$
The number is 8.

2. The unknown number: x

$\boxed{\text{The difference between nine and a number}}$ is $\boxed{\text{seven}}$

$9-x=7$
$9-9-x=7-9$
$-x=-2$
$\frac{-1x}{-1}=\frac{-2}{-1}$
$x=2$
The number is 2.

3. The unknown number: x

$\boxed{\text{Three-fifths of a number}}$ is $\boxed{\text{negative thirty}}$

$\frac{3}{5}x=-30$
$\frac{5}{3}\left(\frac{3}{5}x\right)=\frac{5}{3}(-30)$
$x=-50$
The number is –50.

4. The unknown number: x

$\boxed{\text{The quotient of a number and six}}$ is $\boxed{\text{twelve}}$

$\frac{x}{6}=12$
$\frac{6}{1}\left(\frac{1}{6}x\right)=\frac{6}{1}(12)$
$x=72$
The number is 72.

5. The unknown number: x

$\boxed{\text{Four more than three times a number}}$ is $\boxed{\text{thirteen}}$

$3x + 4 = 13$
$3x + 4 - 4 = 13 - 4$
$3x = 9$
$\frac{3x}{3} = \frac{9}{3}$
$x = 3$
The number is 3.

6. The unknown number: x

$\boxed{\text{The sum of twice a number and five}}$ is $\boxed{\text{fifteen}}$

$2x + 5 = 15$
$2x + 5 - 5 = 15 - 5$
$2x = 10$
$\frac{2x}{2} = \frac{10}{2}$
$x = 5$
The number is 5.

7. The unknown number: x

$\boxed{\text{The difference between nine times a number and six}}$ is $\boxed{\text{twelve}}$

$9x - 6 = 12$
$9x - 6 + 6 = 12 + 6$
$9x = 18$
$\frac{9x}{9} = \frac{18}{9}$
$x = 2$
The number is 2.

8. The unknown number: x

$\boxed{\text{six less than four times a number}}$ is $\boxed{\text{twenty-two}}$

$4x - 6 = 22$
$4x - 6 + 6 = 22 + 6$
$4x = 28$
$\frac{4x}{4} = \frac{28}{4}$
$x = 7$
The number is 7.

9. The unknown number: x

$\boxed{\text{Eight less than the product of eleven and a number}}$ is $\boxed{\text{negative nineteen}}$

$11x - 8 = -19$
$11x - 8 + 8 = -19 + 8$
$11x = -11$
$\frac{11x}{11} = \frac{-11}{11}$
$x = -1$
The number is -1.

10. The unknown number: x

seven more than the product of six and a number	is	eight less than the product of three and the number

$6x + 7 = 3x - 8$
$6x - 3x + 7 = 3x - 3x - 8$
$3x + 7 = -8$
$3x + 7 - 7 = -8 - 7$
$3x = -15$
$\frac{3x}{3} = \frac{-15}{3}$
$x = -5$
The number is –5.

11. The unknown number: x

fifteen less than the product of four and a number	is	product of the number minus eleven and six

$4x - 15 = 6(x - 11)$
$4x - 15 = 6x - 66$
$4x - 6x - 15 = 6x - 6x - 66$
$-2x - 15 = -66$
$-2x - 15 + 15 = -66 + 15$
$-2x = -51$
$\frac{-2x}{-2} = \frac{-51}{-2}$
$x = \frac{51}{2}$
The number is $\frac{51}{2}$.

12. The unknown number: x

Five less than the product of four and a number	is	The product of three and the sum of the number and seven

$4x - 5 = 3(x + 7)$
$4x - 5 = 3x + 21$
$4x - 3x - 5 = 3x - 3x + 21$
$x - 5 = 21$
$x - 5 + 5 = 21 + 5$
$x = 26$
The number is 26.

13. The unknown number: x

Six more than twice the sum of three times a number and eight	is	negative two

$2(3x + 8) + 6 = -2$
$6x + 16 + 6 = -2$
$6x + 22 = -2$
$6x + 22 - 22 = -2 - 22$
$6x = -24$
$\frac{6x}{6} = \frac{-24}{6}$
$x = -4$
The number is –4.

14. The unknown number: x

Three times the difference between the product of four times a number and seven	is	fifteen

$3(4x - 7) = 15$
$12x - 21 = 15$
$12x - 21 + 21 = 15 + 21$
$12x = 36$
$\frac{12x}{12} = \frac{36}{12}$
$x = 3$
The number is 3.

15. The smaller number: x
The larger number: $21 - x$

twice the smaller number	is	three more than the larger number

$2x = 21 - x + 3$
$2x = 24 - x$
$2x + x = 24 - x + x$
$3x = 24$
$\frac{3x}{3} = \frac{24}{3}$
$x = 8$
$21 - x = 21 - 8 = 13$
The smaller number is 8.
The larger number is 13.

16. The smaller number: x
The larger number: $30 - x$

three times the smaller number	is	twice the larger number

$3x = 2(30 - x)$
$3x = 60 - 2x$
$3x + 2x = 60 - 2x + 2x$
$5x = 60$
$\frac{5x}{5} = \frac{60}{5}$
$x = 12$
$30 - x = 30 - 12 = 18$
The smaller number is 12.
The larger number is 18.

17. The smaller number: x
The larger number: $23 - x$

the larger number	is	five more than twice the smaller number

$23 - x = 2x + 5$
$23 - x - 2x = 2x - 2x + 5$
$23 - 3x = 5$
$23 - 23 - 3x = 5 - 23$
$-3x = -18$
$\frac{-3x}{-3} = \frac{-18}{-3}$
$x = 6$
$23 - x = 23 - 6 = 17$
The smaller number is 6.
The larger number is 17.

18. The smaller number: x
The larger number: $25 - x$

$\boxed{\text{the larger number}}$ is $\boxed{\text{five less than four times the smaller number}}$

$25 - x = 4x - 5$
$25 - x - 4x = 4x - 4x - 5$
$25 - 5x = -5$
$25 - 25 - 5x = -5 - 25$
$-5x = -30$
$\dfrac{-5x}{-5} = \dfrac{-30}{-5}$
$x = 6$
$25 - x = 25 - 6 = 19$
The smaller number is 6.
The larger number is 19.

Objective B Exercises, pages 394–396

19. Strategy — To find the original value of the car, write and solve an equation using v to represent the original value.

Solution — $\boxed{\$19{,}900}$ is $\boxed{\tfrac{4}{5}\text{ of its original value}}$

$19{,}900 = \dfrac{4}{5}v$
$\dfrac{5}{4}(19{,}900) = \dfrac{5}{4}\left(\dfrac{4}{5}v\right)$
$24{,}875 = v$
The original value of the car was \$24,875.

20. Strategy — To find the value of the painting five years ago, write and solve an equation using v to represent the value five years ago.

Solution — $\boxed{\$250{,}000}$ is $\boxed{2\tfrac{1}{2}\text{ times the value 5 years ago.}}$

$250{,}000 = \dfrac{5}{2}v$
$\dfrac{2}{5}(250{,}000) = \dfrac{2}{5}\left(\dfrac{5}{2}v\right)$
$100{,}000 = v$
The value of the painting five years ago was \$100,000.

21. Strategy — To find the number of people in Times Square, write and solve an equation using p to represent the number of people in Times Square in New York City.

Solution — $\boxed{5{,}000{,}000}$ is $\boxed{2\tfrac{1}{2}\text{ times as in Times Square}}$

$5{,}000{,}000 = \dfrac{5}{2}p$
$\dfrac{2}{5}(5{,}000{,}000) = \dfrac{2}{5}\left(\dfrac{5}{2}p\right)$
$2{,}000{,}000 = p$
There were 2,000,000 people in Times Square in New York City.

22. Strategy To find the length of the screen, write and solve an equation using L to represent the length of the screen.

Solution $\boxed{15}$ is $\boxed{\frac{3}{4} \text{ the length of the screen}}$

$15 = \frac{3}{4}L$

$\frac{4}{3} \cdot 15 = \frac{4}{3}\left(\frac{3}{4}L\right)$

$20 = L$

The length of the screen is 20 in.

23. Strategy To find the amount spent on advertising and administrative costs, write and solve an equation using a to represent the amount spent on advertising and administrative costs.

Solution $\boxed{\text{Costs plus \$0.44}}$ is $\boxed{\$0.50}$

$a + 0.44 = 0.50$

$a - 0.44 = 0.50 - 0.44$

$a = 0.06$

The amount spent on advertising and administrative costs is 6 cents.

24. Strategy To find the number of words in the vocabulary of the average 14-year-old in the United States today, write and solve an equation using w to represent the number of words.

Solution $\boxed{\text{5,000 more than twice today's 14-year-old's vocabulary}}$ is $\boxed{25{,}000}$

$5{,}000 + 2w = 25{,}000$

$5{,}000 - 5{,}000 + 2w = 25{,}000 - 5{,}000$

$2w = 20{,}000$

$\frac{2w}{2} = \frac{20{,}000}{2}$

$w = 10{,}000$

Today the vocabulary of the average 14-year-old is 10,000 words.

25. Strategy To find the number of tons of paper that is thrown away by American office workers each year, write and solve an equation using n to represent the number of tons of paper.

Solution $\boxed{\text{the amount recycled}}$ is $\boxed{\text{two million more than four times the amount thrown away}}$

$18{,}000{,}000 = 2{,}000{,}000 + 4n$

$18{,}000{,}000 - 2{,}000{,}000 = 2{,}000{,}000 - 2{,}000{,}000 + 4n$

$16{,}000{,}000 = 4n$

$\frac{16{,}000{,}000}{4} = \frac{4n}{4}$

$4{,}000{,}000 = n$

Each year Americans throw away 4,000,000 tons of paper.

26. Strategy To find the number of minutes using the service, write and solve an equation using n to represent the number of minutes.

Solution $\boxed{\text{\$9 plus \$.50 per minute}}$ is $\boxed{\text{\$14.50}}$

$9 + 0.50n = 14.50$
$9 - 9 + 0.50n = 14.50 - 9$
$0.50n = 5.50$
$\frac{0.50n}{0.50} = \frac{5.50}{0.50}$
$n = 11$

The customer used 11 min of hotline service.

27. Strategy To find the number of hours, write and solve an equation using h to represent the number of hours to paint the inside of the house.

Solution $\boxed{\text{\$125 for materials and \$33 per hour for labor}}$ is $\boxed{\text{\$1,346}}$

$125 + 33 \cdot h = 1{,}346$
$125 - 125 + 33h = 1{,}346 - 125$
$33h = 1{,}221$
$\frac{33h}{33} = \frac{1{,}221}{33}$
$h = 37$

37 h of labor was required to paint the house.

28. Strategy To find the number of minutes, write and solve an equation using n to represent the number of minutes using the telephone.

Solution $\boxed{\text{\$15 plus \$.40 per minute}}$ is $\boxed{\text{\$31.80}}$

$15 + 0.40n = 31.80$
$15 - 15 + 0.40n = 31.80 - 15$
$0.40n = 16.80$
$\frac{0.40n}{0.40} = \frac{16.80}{0.40}$
$n = 42$

The business executive used the phone 42 min.

29. Strategy To find the length of each piece, write and solve an equation using x to represent the shorter piece and $12 - x$ to represent the longer piece.

Solution $\boxed{\text{Twice the shorter piece}}$ is $\boxed{\text{three feet less than the longer piece}}$

$2x = (12 - x) - 3$
$2x = 9 - x$
$2x + x = 9 - x + x$
$3x = 9$
$\frac{3x}{3} = \frac{9}{3}$
$x = 3$
$12 - x = 12 - 3 = 9$

The shorter piece is 3 ft.
The longer piece is 9 ft.

30. Strategy To find the length of each piece, write and solve an equation using x to represent the shorter piece and $14-x$ to represent the longer piece.

Solution $\boxed{\text{three times the longer piece}}$ is $\boxed{\text{four times the shorter piece}}$

$3(14-x)=4x$
$42-3x=4x$
$42-3x+3x=4x+3x$
$42=7x$
$\frac{42}{7}=\frac{7x}{7}$
$6=x$
$14-x=14-6=8$
The shorter piece is 6 yd.
The longer piece is 8 yd.

31. Strategy To find the amount of each scholarship, write and solve an equation using x to represent the smaller scholarship and $7{,}000-x$ to represent the larger scholarship.

Solution $\boxed{\text{twice the smaller scholarship}}$ is $\boxed{\text{1,000 less than the larger scholarship}}$

$2x=(7{,}000-x)-1{,}000$
$2x=7{,}000-x-1{,}000$
$2x+x=6{,}000-x+x$
$3x=6{,}000$
$\frac{3x}{3}=\frac{6{,}000}{3}$
$x=2{,}000$
$7{,}000-x=7{,}000-2{,}000=5{,}000$
The larger scholarship is \$5,000.

32. Strategy To find the amount in each account, write and solve an equation using x to represent the amount invested in stocks and $10{,}000-x$ to represent the amount invested in mutual funds.

Solution $\boxed{\text{value of the stock fund}}$ is $\boxed{\text{2,000 less than twice the value of the mutual funds}}$

$x=2(10{,}000-x)-2{,}000$
$x=20{,}000-2x-2{,}000$
$x+2x=18{,}000-2x+2x$
$3x=18{,}000$
$\frac{3x}{3}=\frac{18{,}000}{3}$
$x=6{,}000$
$10{,}000-x=10{,}000-6{,}000=4{,}000$
\$6,000 is invested in stocks and \$4,000 is invested in mutual funds.

33. Strategy To find the number of pounds of each coffee in the mixture, write and solve an equation using x to represent the amount of Colombian, $x + 1$ to represent the amount of French Roast, and $(x + 1) + 2 = x + 3$ to represent the amount of Java.

Solution $\boxed{\text{the total amount of coffee}}$ is $\boxed{\text{10 lb}}$

$x + (x + 1) + (x + 3) = 10$
$3x + 4 = 10$
$3x = 6$
$\frac{3x}{3} = \frac{6}{3}$
$x = 2$
$x + 1 = 2 + 1 = 3$
$x + 3 = 2 + 3 = 5$

The coffee mixture contains 2 lb of Colombian, 3 lb of French Roast, and 5 lb of Java.

34. Strategy To find the number of pounds of each soil supplement, write and solve an equation using x to represent the amount of iron, $2x$ to represent the amount of potassium, and $3x$ to represent the amount of nitrogen.

Solution $\boxed{\text{the total amount of soil supplement}}$ is $\boxed{\text{60 lb}}$

$x + 2x + 3x = 60$
$6x = 60$
$\frac{6x}{6} = \frac{60}{6}$
$x = 10$
$2x = 2(10) = 20$
$3x = 3(10) = 30$

The soil supplement contains 10 lb of iron, 20 lb of potassium, and 30 lb of nitrogen.

Critical Thinking 6.4, page 396

35. $6x + 2 = 5 + 3(2x - 1)$
$6x + 2 = 5 + 6x - 3$
$6x + 2 = 6x + 2$
Identity

36. $3 - 2(4x + 1) = 5 + 8(1 - x)$
$3 - 8x - 2 = 5 + 8 - 8x$
$1 - 8x + 8x = 13 - 8x + 8x$
$1 = 13$
Contradiction

37. $3t - 5(t + 1) = 2(2 - t) - 9$
$3t - 5t - 5 = 4 - 2t - 9$
$-2t - 5 = -2t - 5$
Identity

38. $6 + 4(2y + 1) = 5 - 8y$
$6 + 8y + 4 = 5 - 8y$
$8y + 10 = 5 - 8y$
$8y + 8y + 10 = 5 - 8y + 8y$
$16y + 10 = 5$
$16y + 10 - 10 = 5 - 10$
$16y = -5$
$\frac{16y}{16} = \frac{-5}{16}$
$y = -\frac{-5}{16}$
Conditional equation
The solution is $-\frac{5}{16}$.

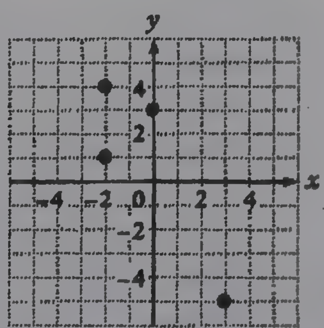
39. $3v - 2 = 5v - 2(2 + v)$
$3v - 2 = 5v - 4 - 2v$
$3v - 2 = 3v - 4$
$3v - 3v - 2 = 3v - 3v - 4$
$-2 = -4$
Contradiction

40. $9z = 15z$
$9z - 15z = 0$
$-6z = 0$
$\frac{-6z}{-6} = \frac{0}{-6}$
$z = 0$
Conditional equation
The solution is 0.

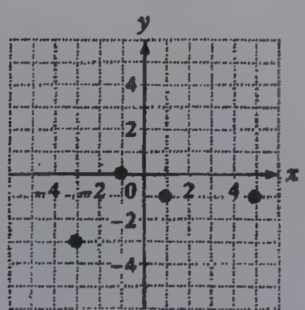
Section 6.5

Objective A Exercises, pages 403–404

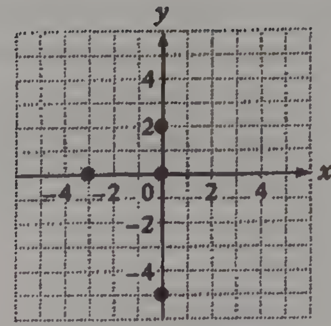
3.



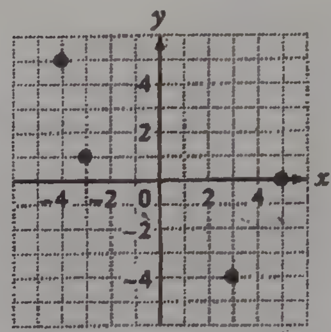
4.



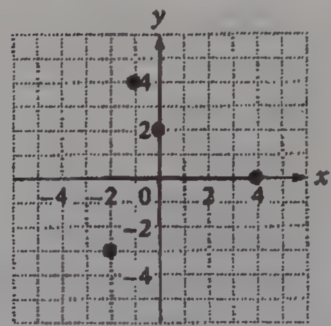
5.



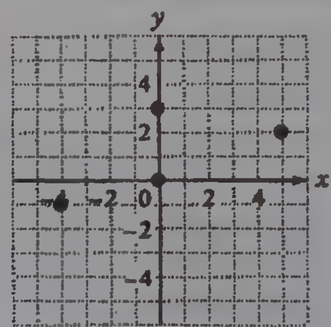
6.



7.



8.



9. $A(2, 3)$
$B(4, 0)$
$C(-4, 1)$
$D(-2, -2)$

10. $A(0, 2)$
$B(-4, -1)$
$C(2, 0)$
$D(1, -3)$

11. $A(-2, 5)$
$B(3, 4)$
$C(0, 0)$
$D(-3, -2)$

12. $A(0, 4)$
$B(-4, 3)$
$C(-2, 0)$
$D(2, -3)$

13 a. Abscissa of point A: 2
Abscissa of point C: –4

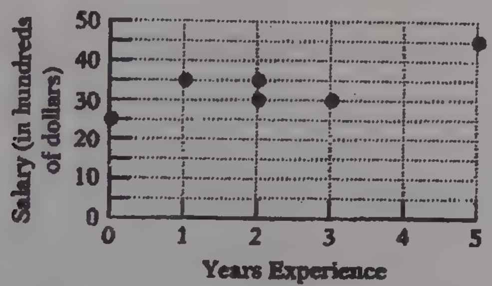
b. Ordinate of point B: 1
Ordinate of point D: –3

14 a. Abscissa of point A: 0
Abscissa of point C: 3

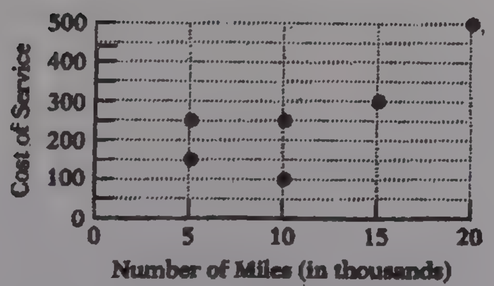
b. Ordinate of point B: 1
Ordinate of point D: –1

Objective B Exercises, page 404

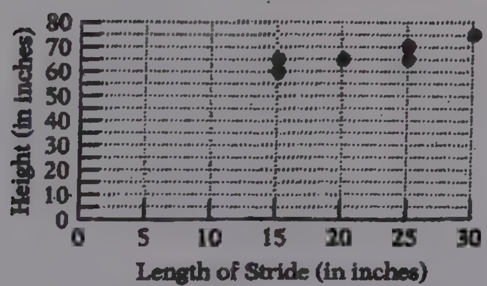
15.



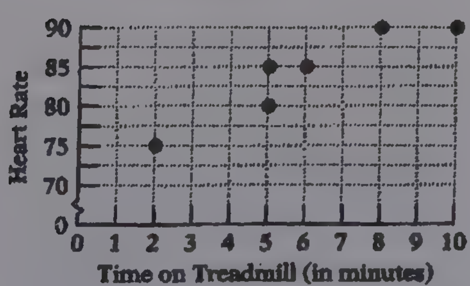
16.



17.



18.



Objective C Exercises, page 405

19.
$$\begin{array}{c|l} \multicolumn{2}{c}{y=-x+7} \\ \hline 4 & -(3)+7 \\ & -3+7 \\ & 4 \end{array}$$
$4 = 4$
Yes, (3, 4) is a solution of $y - x + 7$.

20.
$$\begin{array}{c|l} \multicolumn{2}{c}{y=x+5} \\ \hline -3 & 2+5 \\ & 7 \end{array}$$
$-3 \neq 7$
No, (2, –3) is not a solution of $y = x + 5$.

21.
$$\begin{array}{c|l} \multicolumn{2}{c}{y=\frac{1}{2}x-1} \\ \hline 2 & \frac{1}{2}(-1)-1 \\ & -\frac{1}{2}-1 \\ & -\frac{3}{2} \end{array}$$
$2 \neq -\frac{3}{2}$
No, (–1, 2) is not a solution of $y=\frac{1}{2}x-1$.

22.
$$\begin{array}{c|l} \multicolumn{2}{c}{y=-2x-1} \\ \hline -3 & -2(1)-1 \\ & -2-1 \\ & -3 \end{array}$$
$-3 = -3$
Yes, (1, –3) is a solution of $y = -2x - 1$.

23.
$$\begin{array}{c|l} \multicolumn{2}{c}{y=\frac{1}{4}x+1} \\ \hline 1 & \frac{1}{4}(4)+1 \\ & 1+1 \\ & 2 \end{array}$$
$1 \neq 2$
No, (4, 1) is not a solution of $y=\frac{1}{4}x+1$.

24.
$$\begin{array}{c|l} \multicolumn{2}{c}{y=-\frac{2}{5}x+1} \\ \hline 3 & -\frac{2}{5}(-5)+1 \\ & 2+1 \end{array}$$
$3 = 3$
Yes, (–5, 3) is a solution of $y=-\frac{2}{5}x+1$.

25. $y=\frac{3}{4}x+4$

$$\begin{array}{c|l} 4 & \frac{3}{4}(0)+4 \\ & 0+4 \\ & 4 \end{array}$$

$4=4$

Yes, (0, 4) is a solution of $y=\frac{3}{4}x+4$.

26. $y=-\frac{1}{2}x-1$

$$\begin{array}{c|l} 0 & -\frac{1}{2}(-2)-1 \\ & 1-1 \\ & 0 \end{array}$$

$0=0$

Yes, (–2, 0) is a solution of $y=-\frac{1}{2}x-1$.

27. $y=3x+2$

$$\begin{array}{c|l} 0 & 3(0)+2 \\ & 0+2 \\ & 2 \end{array}$$

$0\neq 2$

No, (0, 0) is not a solution of $y=3x+2$.

28. $y=-\frac{3}{4}x$

$$\begin{array}{c|l} 0 & -\frac{3}{4}(0) \\ & 0 \end{array}$$

$0=0$

Yes, (0, 0) is a solution of $y=-\frac{3}{4}x$.

29. $y=3x-2$
$=3(3)-2$
$=9-2$
$=7$
The ordered-pair solution is (3, 7).

30. $y=4x+1$
$=4(-1)+1$
$=-4+1$
$=-3$
The ordered-pair solution is (–1, –3).

31. $y=\frac{2}{3}x-1$
$=\frac{2}{3}(6)-1$
$=4-1$
$=3$
The ordered-pair solution is (6, 3).

32. $y=\frac{3}{4}x-2$
$=\frac{3}{4}(4)-2$
$=3-2$
$=1$
The ordered-pair solution is (4, 1).

33. $y=-3x+1$
$=-3(0)+1$
$=0+1$
$=1$
The ordered-pair solution is (0, 1).

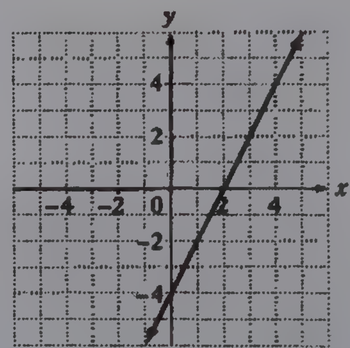
34. $y=\frac{2}{5}x-5$
$=\frac{2}{5}(0)-5$
$=0-5$
$=-5$
The ordered-pair solution is (0, –5).

35. $y=\frac{2}{5}x+2$
$=\frac{2}{5}(-5)+2$
$=-2+2$
$=0$
The ordered-pair solution is (–5, 0).

36. $y=-\frac{1}{6}x-2$
$=-\frac{1}{6}(12)-2$
$=-2-2$
$=-4$
The ordered-pair solution is (12, –4).

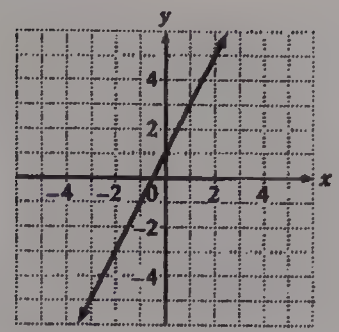
37.

x	y
0	–4
2	0
4	4



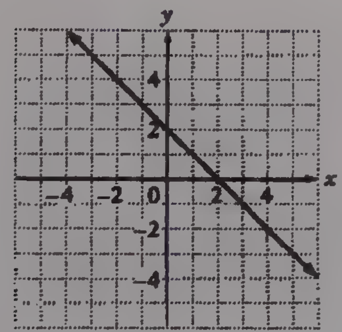
38.

x	y
−2	−3
0	1
1	3



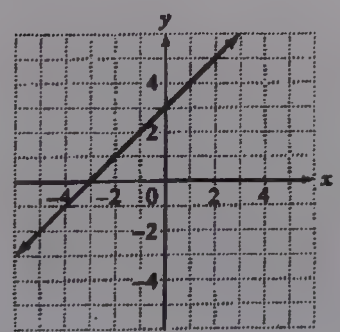
39.

x	y
−2	4
2	0
4	−2



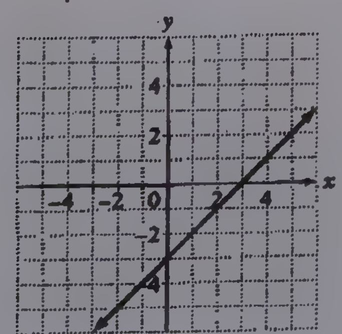
40.

x	y
−4	−1
−1	2
1	4



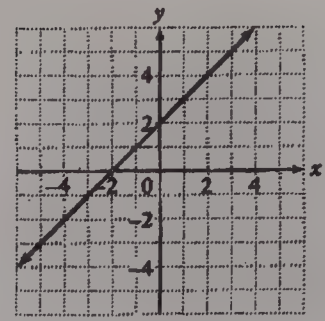
41.

x	y
−1	−4
2	−1
4	1



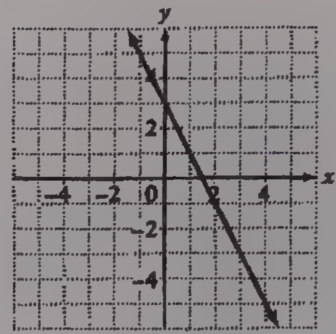
42.

x	y
−4	−2
−2	0
2	4



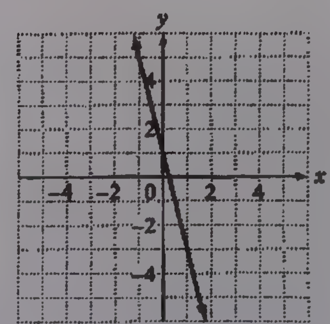
43.

x	y
0	3
1	1
3	−3



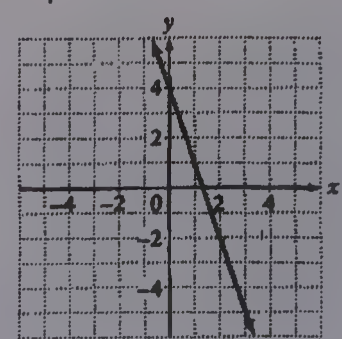
44.

x	y
0	1
1	−3
−1	5



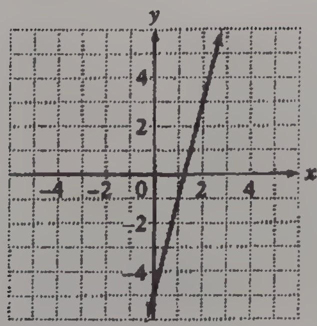
45.

x	y
0	4
1	1
2	−2



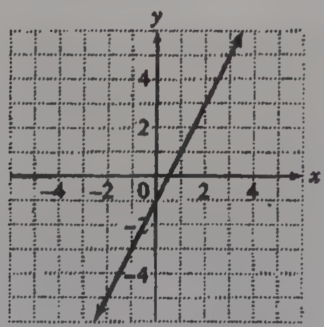
46.

x	y
0	−5
1	−1
2	3



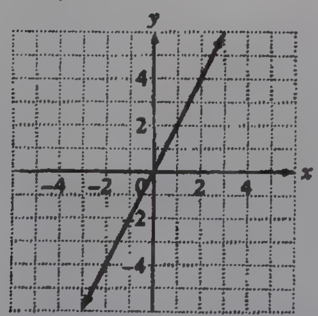
47.

x	y
−1	−3
0	−1
2	3



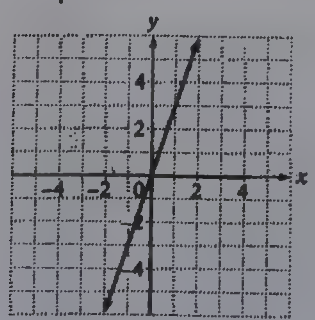
48.

x	y
−1	−2
0	0
1	2



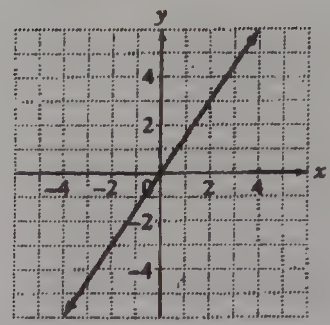
49.

x	y
−1	−3
0	0
1	3



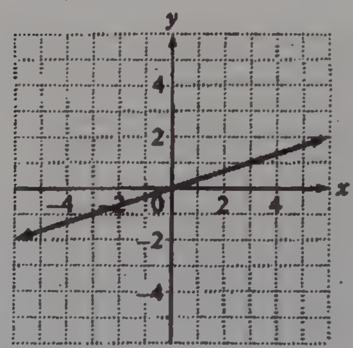
50.

x	y
2	3
0	0
−2	−3



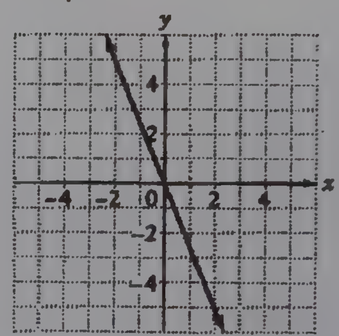
51.

x	y
3	1
0	0
−3	−1



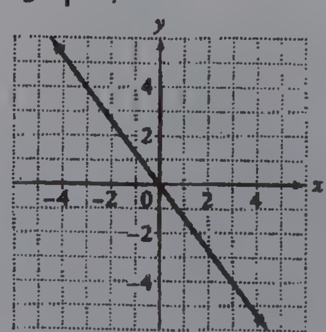
52.

x	y
2	−5
0	0
−2	5



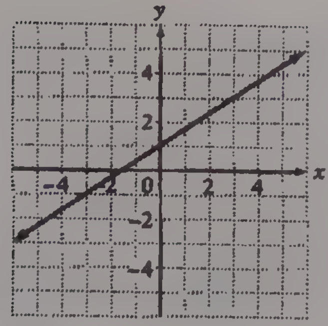
53.

x	y
−3	4
0	0
3	−4



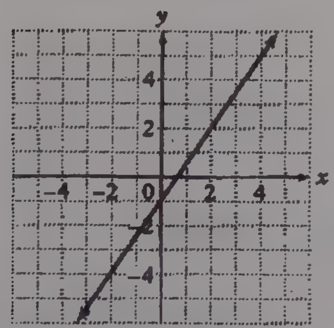
54.

x	y
-3	-1
0	1
3	3



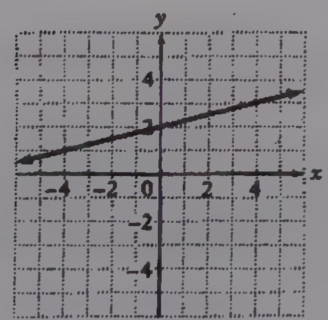
55.

x	y
-2	-4
0	-1
2	2



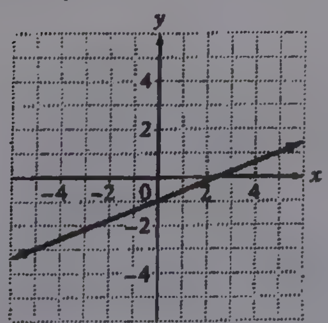
56.

x	y
-4	1
0	2
4	3



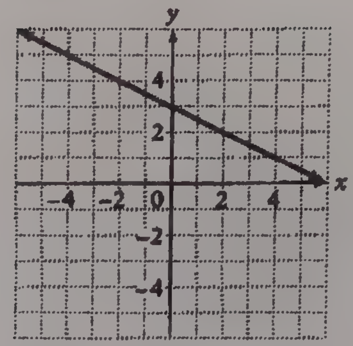
57.

x	y
-5	-3
0	-1
5	1



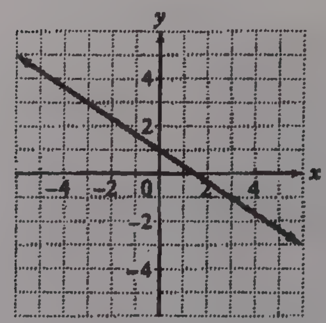
58.

x	y
-2	4
0	3
2	2



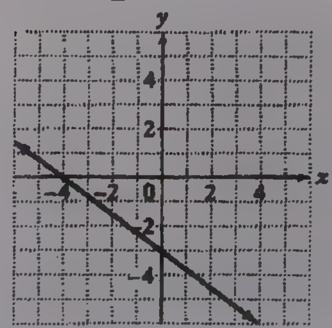
59.

x	y
-3	3
0	1
3	-1



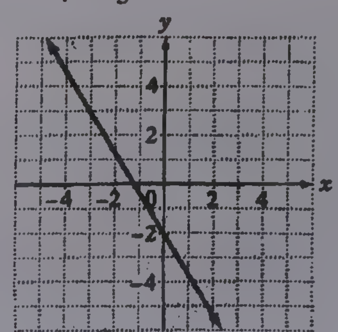
60.

x	y
-4	0
0	-3
-2	$-\frac{3}{2}$



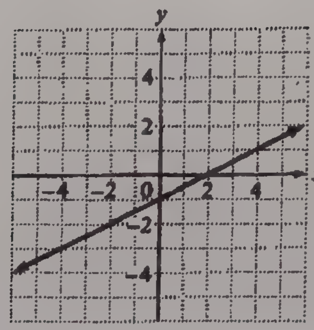
61.

x	y
-3	3
0	-2
1	$-\frac{11}{3}$



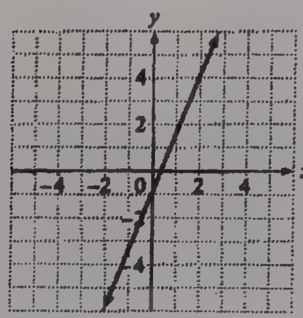
62.

x	y
−2	−2
0	−1
2	0



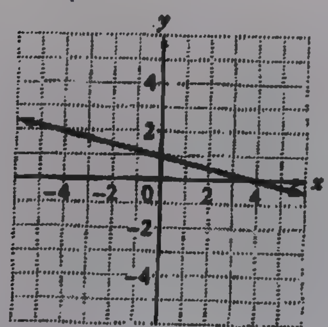
63.

x	y
2	4
0	−1
−2	−6



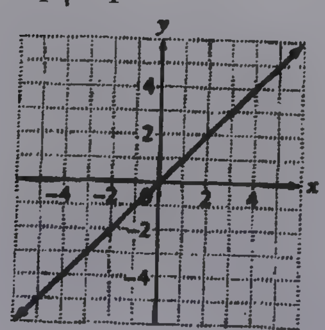
64.

x	y
−4	2
0	1
4	0



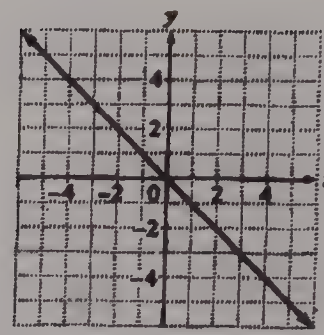
65.

x	y
1	1
0	0
−1	−1

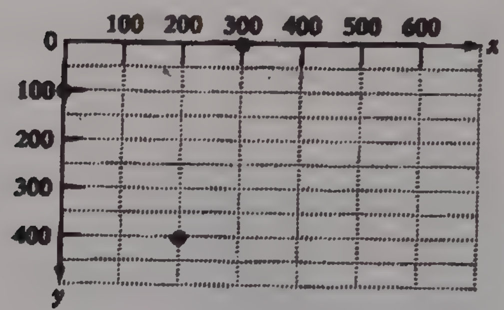


66.

x	y
−2	2
0	0
2	−2



67.



Critical Thinking 6.5, page 408

68. a. To find the coordinates of the point at which the graph of $y = 2x + 1$ crosses the y-axis, substitute 0 for x and solve for y.

$y = 2x + 1$
$y = 2(0) + 1$
$y = 1$

The graph of $y = 2x + 1$ will cross the y-axis at the point (0,1).

b. To find the coordinates of the point at which the graph of $y = 3x - 6$ crosses the x–axis, substitute 0 for y and solve for x.

$y = 3x - 6$
$0 = 3x - 6$
$6 = 3x$
$2 = x$

The graph of $y = 3x - 6$ will cross the x-axis at (2, 0).

69. a. For $x = 3$:

$y = 3x - 4$
$y = 3(3) - 4$
$y = 9 - 4$
$y = 5$

For $x = 4$:

$y = 3(4) - 4$
$y = 12 - 4$
$y = 8$

Thus the value of y increases by 3.

b. For $x = 3$:
$y = -2x + 1$
$y = -2(3) + 1$
$y = -6 + 1$
$y = -5$
For $x = 4$:
$y = -2(4) + 1$
$y = -8 + 1$
$y = -7$
Thus the value of y decreases by 2.

Chapter Review Exercises, pages 411–412

1. $z + 5 = 2$
$z + 5 - 5 = 2 - 5$
$z = -3$
The solution is –3.

2. $-8x + 4x = -12$
$-4x = -12$
$\frac{-4x}{-4} = \frac{-12}{-4}$
$x = 3$
The solution is 3.

3. $7 = 8a - 5$
$7 + 5 = 8a - 5 + 5$
$12 = 8a$
$\frac{12}{8} = \frac{8a}{8}$
$\frac{3}{2} = a$
The solution is $\frac{3}{2}$.

4. $7 + a = 0$
$7 - 7 + a = 0 - 7$
$a = -7$
The solution is –7.

5. $40 = -\frac{5}{3}y$
$-\frac{3}{5}(40) = \left(-\frac{3}{5}\right)\left(-\frac{5}{3}y\right)$
$-24 = y$
The solution is –24.

6. $-\frac{3}{8} = \frac{4}{5}z$
$\frac{5}{4}\left(-\frac{3}{8}\right) = \frac{5}{4}\left(\frac{4}{5}z\right)$
$-\frac{15}{32} = z$
The solution is $-\frac{15}{32}$.

7. $9 - 5y = -1$
$9 - 9 - 5y = -1 - 9$
$-5y = -10$
$\frac{-5y}{-5} = \frac{-10}{-5}$
$y = 2$
The solution is 2.

8. $-4(2 - x) = x + 9$
$-8 + 4x = x + 9$
$-8 + 4x - x = x - x + 9$
$-8 + 3x = 9$
$-8 + 8 + 3x = 9 + 8$
$3x = 17$
$\frac{3x}{3} = \frac{17}{3}$
$x = \frac{17}{3}$
The solution is $\frac{17}{3}$.

9. $3a + 8 = 12 - 5a$
$3a + 5a + 8 = 12 - 5a + 5a$
$8a + 8 = 12$
$8a + 8 - 8 = 12 - 8$
$8a = 4$
$\frac{8a}{8} = \frac{4}{8}$
$a = \frac{1}{2}$
The solution is $\frac{1}{2}$.

10. $12p - 7 = 5p - 21$
$12p - 5p - 7 = 5p - 5p - 21$
$7p - 7 = -21$
$7p - 7 + 7 = -21 + 7$
$7p = -14$
$\frac{7p}{7} = \frac{-14}{7}$
$p = -2$
The solution is –2.

11. $3(2n - 3) = 2n + 3$
$6n - 9 = 2n + 3$
$6n - 2n - 9 = 2n - 2n + 3$
$4n - 9 = 3$
$4n - 9 + 9 = 3 + 9$
$4n = 12$
$\frac{4n}{4} = \frac{12}{4}$
$n = 3$
The solution is 3.

12. $3m = -12$

$\frac{3m}{3} = \frac{-12}{3}$

$m = -4$

The solution is –4.

13. $4 - 3(2p + 1) = 3p + 11$

$4 - 6p - 3 = 3p + 11$

$-6p + 1 = 3p + 11$

$-6p - 3p + 1 = 3p - 3p + 11$

$-9p + 1 = 11$

$-9p + 1 - 1 = 11 - 1$

$-9p = 10$

$\frac{-9p}{-9} = \frac{10}{-9}$

$p = -\frac{10}{9}$

The solution is $-\frac{10}{9}$.

14. $1 + 4(2c - 3) = 3(3c - 5)$

$1 + 8c - 12 = 9c - 15$

$8c - 11 = 9c - 15$

$8c - 9c - 11 = 9c - 9c - 15$

$-c - 11 = -15$

$-c - 11 + 11 = -15 + 11$

$-c = -4$

$\frac{-1c}{-1} = \frac{-4}{-1}$

$c = 4$

The solution is 4.

15. $\frac{3x}{4} + 10 = 7$

$\frac{3x}{4} + 10 - 10 = 7 - 10$

$\frac{3x}{4} = -3$

$\left(\frac{4}{3}\right)\left(\frac{3}{4}x\right) = \frac{4}{3}(-3)$

$x = -4$

The solution is –4.

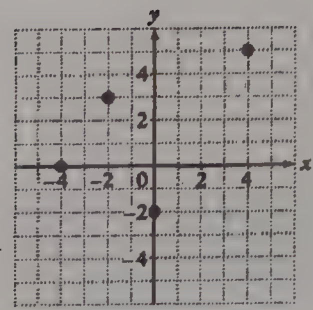
16. $y = \frac{1}{5}x + 2$

0	$\frac{1}{5}(-10) + 2$
0	$-2 + 2$

$0 = 0$

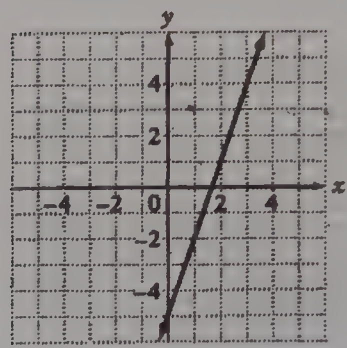
Yes, (–10, 0) is a solution of the equation.

17.



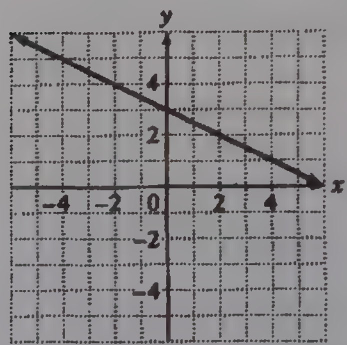
18.

x	y
0	–5
1	–2
2	1



19.

x	y
–2	4
0	3
2	2



20. $y = 4x - 9$

$y = 4(2) - 9$

$y = 8 - 9$

$y = -1$

The ordered-pair solution is (2, –1).

21. The unknown number: x

$\boxed{\text{the difference between seven and the product of five and a number}}$ is $\boxed{\text{thirty-seven}}$

$7 - 5x = 37$

$7 - 7 - 5x = 37 - 7$

$-5x = 30$

$\frac{-5x}{-5} = \frac{30}{-5} = -6$

$x = -6$

The number is –6.

22. Strategy To find the length of each piece, write and solve an equation using x to represent the shorter piece and $24 - x$ to represent the longer piece.

Solution $\boxed{\text{Twice the length of the shorter piece}}$ equals $\boxed{\text{the length of the longer piece}}$

$2x = 24 - x$

$2x + x = 24 - x + x$

$3x = 24$

$\frac{3x}{3} = \frac{24}{3}$

$x = 8$

$24 - x = 24 - 8 = 16$

The longer piece is 16 in.

23. Strategy To find the number of hours of consultation, write and solve an equation using n to represent the number of hours.

Solution $\boxed{\text{\$250 plus \$150 per hour}}$ is $\boxed{\text{\$1,300}}$

$250 + 150 \cdot n = 1{,}300$

$250 - 250 + 150n = 1{,}300 - 250$

$150n = 1{,}050$

$\frac{150n}{150} = \frac{1{,}050}{150}$

$n = 7$

The consulting fee was for 7 h of consultation.

24. Strategy To find the height of the leaning tower of Pisa, write and solve an equation using h to represent the height of the tower.

Solution $\boxed{\text{302 m}}$ is $\boxed{\text{28 m less than six times the height}}$

$302 = 6h - 28$

$302 + 28 = 6h - 28 + 28$

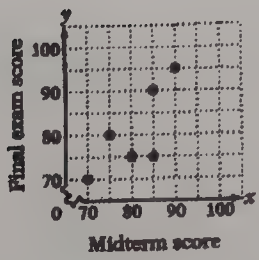
$330 = 6h$

$\frac{330}{6} = \frac{6h}{6}$

$55 = h$

The leaning tower of Pisa is 55 m high.

25.



26. Strategy: To find the force, substitute 18 for d, 6 for x, and 25 for F_1 in the given equation and solve for F_2.

Solution:
$$F_1x = F_2(d-x)$$
$$25(6) = F_2(18-6)$$
$$150 = 12F_2$$
$$\frac{150}{12} = \frac{12F_2}{12}$$
$$12.5 = F_2$$
The force needed to balance the system is 12.5 lb.

27. Strategy: To find the number of amplifiers, substitute 38,669 for T, 127 for U, and 20,000 for F in the given equation and solve for N.

Solution:
$$T = U \cdot N + F$$
$$38{,}669 = 127 \cdot N + 20{,}000$$
$$38{,}669 - 20{,}000 = 127N$$
$$18{,}669 = 127N$$
$$\frac{18{,}699}{127} = \frac{127N}{127}$$
$$147 = N$$
147 amplifiers were produced during the month.

Chapter Test, pages 413–414

1.
$$7 + x = 2$$
$$7 - 7 + x = 2 - 7$$
$$a = -5$$
The solution is –5.

2.
$$-\frac{3}{5}y = 6$$
$$\left(-\frac{5}{3}\right)\left(-\frac{3}{5}y\right) = 6\left(-\frac{5}{3}\right)$$
$$y = -10$$
The solution is –10.

3.
$$2d - 7 = -13$$
$$2d - 7 + 7 = -13 + 7$$
$$2d = -6$$
$$\frac{2d}{2} = \frac{-6}{2}$$
$$d = -3$$
The solution is –3.

4.
$$4 - 5c = -11$$
$$4 - 4 - 5c = -11 - 4$$
$$-5c = -15$$
$$\frac{-5c}{-5} = \frac{-15}{-5}$$
$$c = 3$$
The solution is 3.

5.
$$3x + 4 = 24 - 2x$$
$$3x + 2x + 4 = 24 - 2x + 2x$$
$$5x + 4 = 24$$
$$5x + 4 - 4 = 24 - 4$$
$$5x = 20$$
$$\frac{5x}{5} = \frac{20}{5}$$
$$x = 4$$
The solution is 4.

6.
$$7 - 5y = 6y - 26$$
$$7 - 5y + 5y = 6y + 5y - 26$$
$$7 = 11y - 26$$
$$7 + 26 = 11y - 26 + 26$$
$$33 = 11y$$
$$\frac{33}{11} = \frac{11y}{11}$$
$$y = 3$$
The solution is 3.

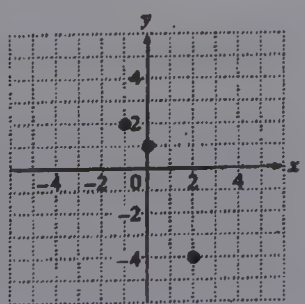
7.
$$2t - 3(4 - t) = t - 8$$
$$2t - 12 + 3t = t - 8$$
$$5t - 12 = t - 8$$
$$5t - t - 12 = t - t - 8$$
$$4t - 12 = -8$$
$$4t - 12 + 12 = -8 + 12$$
$$4t = 4$$
$$\frac{4t}{4} = \frac{4}{4}$$
$$t = 1$$
The solution is 1.

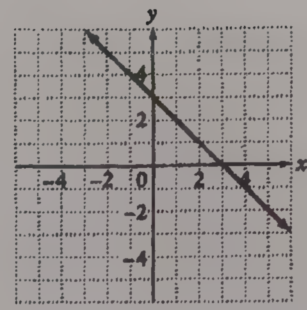
8. $12 - 3(n - 5) = 5n - 3$
$12 - 3n + 15 = 5n - 3$
$-3n + 27 = 5n - 3$
$-3n - 5n + 27 = 5n - 5n - 3$
$-8n + 27 = -3$
$-8n + 27 - 27 = -3 - 27$
$-8n = -30$
$\frac{-8n}{-8} = \frac{-30}{-8}$
$n = \frac{15}{4}$
The solution is $\frac{15}{4}$.

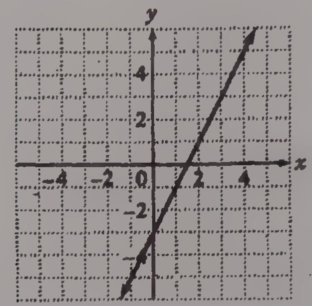
9. $\frac{3}{8} - n = \frac{2}{3}$
$\frac{3}{8} - \frac{3}{8} - n = \frac{2}{3} - \frac{3}{8}$
$-n = \frac{7}{24}$
$\frac{-n}{-1} = \left(\frac{7}{24}\right)\left(\frac{1}{-1}\right)$
$n = \frac{-7}{24}$
The solution is $-\frac{7}{24}$.

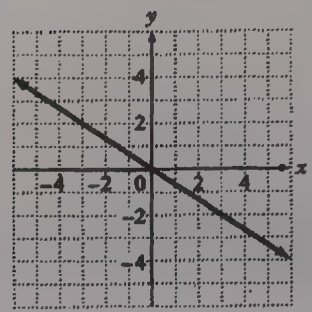
10. $3p - 2 + 5p = 2p + 12$
$8p - 2 = 2p + 12$
$8p - 2p - 2 = 2p - 2p + 12$
$6p - 2 = 12$
$6p - 2 + 2 = 12 + 2$
$6p = 14$
$\frac{6p}{6} = \frac{14}{6}$
$p = \frac{7}{3}$
The solution is $\frac{7}{3}$.

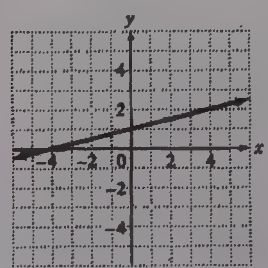
11. $A(-3, 1)$

12.


13.


14.


15.


16.


17. $2(4b - 14) = b - 7$
$8b - 28 = b - 7$
$8b - b - 28 = b - b - 7$
$7b - 28 = -7$
$7b - 28 + 28 = -7 + 28$
$7b = 21$
$\frac{7b}{7} = \frac{21}{7}$
$b = 3$
The solution is 3.

18. $\frac{5y}{3}+12=2$

$\frac{5y}{3}+12-12=2-12$

$\frac{5y}{3}=-10$

$\left(\frac{3}{5}\right)\left(\frac{5y}{3}\right)=-10\left(\frac{3}{5}\right)$

$y=-6$

The solution is –6.

19. $y=\frac{1}{3}x-4$

$y=\frac{1}{3}(6)-4$

$y=2-4$

$y=-2$

The ordered-pair solution is (6, –2).

20. The unknown number: n

Four plus one third of a number	is	nine

$4+\frac{1}{3}n=9$

$4-4+\frac{1}{3}n=9-4$

$\frac{1}{3}n=5$

$\left(\frac{3}{1}\right)\left(\frac{1}{3}n\right)=5\left(\frac{3}{1}\right)$

$n=15$

The number is 15.

21. The unknown number: n

Sum of eight and the product of two and a number	is	negative 4

$8+2n=-4$

$8-8+2n=-4-8$

$2n=-12$

$\frac{2n}{2}=\frac{-12}{2}$

$n=-6$

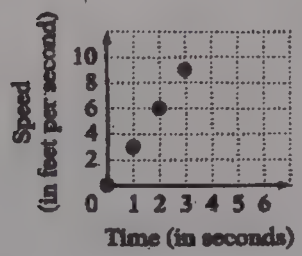
The number is –6.

22. The smaller number: x
The larger number: $17 - x$

Four times the smaller number and two times the larger number	is	Forty four

$4x + 2(17 - x) = 44$
$4x + 34 - 2x = 44$
$2x + 34 = 44$
$2x + 34 - 34 = 44 - 34$
$2x = 10$
$\frac{2x}{2} = \frac{10}{2}$
$x = 5$
$17 - x = 17 - 5 = 12$
The smaller number is 5.
The larger number is 12.

23.



24. Strategy To find the number of hours of labor, write and solve an equation using n to represent the number of hours.

Solution

$85 plus $48 per hour	is	$325

$85 + 48 \cdot n = 325$
$85 - 85 + 48n = 325 - 85$
$48n = 240$
$\frac{48n}{48} = \frac{240}{48}$
$n = 5$
The job required 5 h of labor.

25. Strategy To find the depth, substitute 65 for P in the given equation and solve for D.

Solution
$P = 15 + \frac{1}{2}D$
$65 = 15 + \frac{1}{2}D$
$65 - 15 = 15 - 15 + \frac{1}{2}D$
$50 = \frac{1}{2}D$
$\left(\frac{2}{1}\right)50 = \left(\frac{2}{1}\right)\left(\frac{1}{2}D\right)$
$100 = D$
The depth is 100 ft.

Cumulative Review Exercises, pages 415–416

1. $-3ab$
$-3(-2)(3) = 6(3)$
$= 18$

2. $-3(4p-7) = -12p + 21$

3. $\left(\frac{2}{3}\right)\left(-\frac{9}{8}\right)+\frac{3}{4} = -\frac{2\cdot 9}{3\cdot 8}+\frac{3}{4}$
$= -\frac{3}{4}+\frac{3}{4}$
$= 0$

4. $-\frac{2}{3}y = 12$
$\left(-\frac{3}{2}\right)\left(-\frac{2}{3}y\right) = -\frac{3}{2}(12)$
$y = -18$
The solution is -18.

5. $(-b)^3$
$[-(-2)]^3 = 2^3$
$= 8$

6. $4xy^2 - 2xy$
$4(-2)(3^2) - 2(-2)(3)$
$= 4(-2)(9) - 2(-2)(3)$
$= -8(9) - 2(-2)(3)$
$= -72 - 2(-2)(3)$
$= -72 - (-4)(3)$
$= -72 - (-12)$
$= -72 + 12$
$= -60$

7. $\sqrt{121} = 11$

8. $\sqrt{48} = \sqrt{16\cdot 3}$
$= \sqrt{16}\cdot\sqrt{3}$
$= 4\sqrt{3}$

9. $4(3v-2) - 5(2v-3)$
$= 12v - 8 - 10v + 15$
$= (12v - 10v) + (-8 + 15)$
$= 2v + 7$

10. $-4(-3m) = [(-4)(-3)]m$
$= 12m$

11. $\begin{array}{r|l} -5d & = -45 \\ \hline -5(-9) & -45 \end{array}$
$45 \neq -45$
No, -9 is not a solution of the equation.

12. $5 - 7a = 3 - 5a$
$5 - 7a + 5a = 3 - 5a + 5a$
$5 - 2a = 3$
$5 - 5 - 2a = 3 - 5$
$-2a = -2$
$\frac{-2a}{-2} = \frac{-2}{-2}$
$a = 1$
The solution is 1.

13. $6 - 2(7z - 3) + 4z = 6 - 14z + 6 + 4z$
$= (-14z + 4z) + (6 + 6)$
$= -10z + 12$

14. $\frac{a^2+b^2}{2ab}$
$\frac{(-2)^2+(-1)^2}{2(-2)(-1)} = \frac{4+1}{4}$
$= \frac{5}{4}$

15. $8z - 9 = 3$
$8z - 9 + 9 = 3 + 9$
$8z = 12$
$\frac{8z}{8} = \frac{12}{8}$
$z = \frac{3}{2}$
The solution is $\frac{3}{2}$.

16. $(2m^2n^5)^5 = 2^{1\cdot 5}m^{2\cdot 5}n^{5\cdot 5}$
$= 32m^{10}n^{25}$

17. $-3a^3(2a^2 + 3ab - 4b^2)$
$= -3a^3(2a^2) + (-3a^3)(3ab) - (-3a^3)(4b^2)$
$= -6a^5 - 9a^4b + 12a^3b^2$

18. $(2x-3)(3x+1) = 6x^2 + 2x - 9x - 3$
$= 6x^2 - 7x - 3$

19. $2^{-4} = \frac{1}{2^4} = \frac{1}{16}$

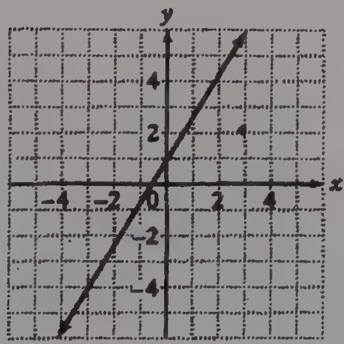
20. $\frac{x^8}{x^2} = x^{8-2} = x^6$

21. $(-5x^3y)(-3x^5y^2)$
$= [(-5)(-3)](x^3x^5)(yy^2)$
$= 15x^8y^3$

22. $5 - 3(2x - 8) = -2(1 - x)$
$5 - 6x + 24 = -2 + 2x$
$-6x + 29 = -2 + 2x$
$-6x - 2x + 29 = -2 + 2x - 2x$
$-8x + 29 = -2$
$-8x + 29 - 29 = -2 - 29$
$-8x = -31$
$\frac{-8x}{-8} = \frac{-31}{-8}$
$x = \frac{31}{8}$
The solution is $\frac{31}{8}$.

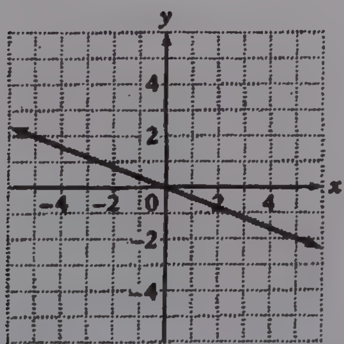
23.

x	y
3	6
0	1
−3	−4



24.

x	y
5	−2
0	0
−5	2



25. $3.5 \times 10^{-8} = 0.000000035$

26. The <u>product</u> of five and the <u>sum</u> of a number and two
$5(n + 2)$
$5n + 10$

27. Strategy To find the time, replace v by 98 and v_0 by 50 in the given formula and solve for t.

Solution $v = v_0 + 32t$
$98 = 50 + 32t$
$98 - 50 = 50 - 50 + 32t$
$48 = 32t$
$\frac{48}{32} = \frac{32t}{32}$
$1.5 = t$
The time is 1.5 s.

28. The speed of sound: x
The speed of a turbo-prop plane: $\frac{1}{2}x$

29. Strategy To find the total box office gross, add the totals for the four films.

Solution $461.0 + 290.2 + 260.0 + 181.3$
$= 1{,}192.5$
The total box office gross for all four films is \$1,192.5 million.

30. Strategy To find the interest payment, write and solve an equation using I to represent the amount of interest and $I - 204$ to represent the amount of principal.

Solution $I + \text{Principal} = 949$
$I + I - 204 = 949$
$2I = 1{,}153$
$\frac{2I}{2} = \frac{1{,}153}{2}$
$I = 576.50$
The interest payment is \$576.50.

31. Strategy To find the number of stories, divide the depth of the Aleutian Trench (8,100) by the height of one story (4.2).

Solution $8{,}100 \div 4.2 \approx 1{,}929$
A skyscraper with 1,929 stories is as tall as the Aleutian Trench.

32. Strategy To find the amount donated to each charity, write and solve an equation using x to represent the donation to one charity and $2x$ to represent the donation to the other charity.

Solution
$x + 2x = 12{,}000$
$3x = 12{,}000$
$\frac{3x}{3} = \frac{12{,}000}{3}$
$x = 4{,}000$
$2x = 2(4{,}000) = 8{,}000$
One charity received $4,000 and the other charity received $8,000.

Chapter 7

Section 7.1

Objective A Exercises, pages 423–426

3. a. giga-: 10^9
   mega-: 1,000,000
   kilo-: k, 10^4
   hecto-: 10^2
   deca-: 10
   deci-: 0.1
   centi-: c, 0.01
   milli-: m, $\frac{1}{10^3}$
   micro-: 0.000001
   nano-: 0.000000001
   pico-: $\frac{1}{10^{12}}$

   b. The exponent 10 indicates the number of places to move the decimal point. For prefixes tera-, giga-, mega-, kilo-, hecto-, and deca-, move the decimal point to the right. For other prefixes shown, move the decimal point to the left.

4. kilometer
5. kilogram
6. centimeter
7. milliliter
8. gram
9. kiloliter
10. meter
11. centimeter
12. gram
13. kilogram
14. milliliter
15. liter
16. gram
17. gram
18. millimeter
19. meter
20. milligram
21. kilogram
22. gram
23. milliliter
24. kiloliter
25. kilogram
26. milliliter
27. kilometer
28. 42 cm = 420 mm
29. 91 cm = 910 mm
30. 360 g = 0.36 kg
31. 1,856 g = 1.856 kg
32. 5,194 ml = 5.194 L
33. 7,285 ml = 7.285 L
34. 2 m = 2,000 mm
35. 8 m = 8,000 mm
36. 217 mg = 0.217 g
37. 34 mg = 0.034 g
38. 4.52 L = 4,520 ml
39. 0.0297 L = 29.7 ml
40. 8,406 m = 8.406 km
41. 7,530 m = 7.530 km
42. 2.4 kg = 2,400 g
43. 9.2 kg = 9,200 g
44. 6.18 kl = 6,180 L
45. 0.036 kl = 36 L

46. 9.612 km = 9,612 m

47. 2.35 km = 2,350 m

48. 0.24 g = 240 mg

49. 0.083 g = 83 mg

50. 298 cm = 2.98 m

51. 71.6 cm = 0.716 m

52. 2,431 L = 2.43 kl

53. 6.302 L = 6,302 kl

54. 0.66 m = 66 cm

55. 4.58 m = 458 cm

56. 243 mm = 24.3 cm

57. 92 mm = 9.2 cm

58. Strategy

a. To find the number of kilometers, convert meters to kilometers.

b. To find the number of kilometers, convert meters to kilometers.

Solution

a. 50,000 m = 50 km
The entrants walk 50 km.

b. 10,000 m = 10 km
The entrants skate 10 km.

59. Strategy To find the weight:
→Multiply the number of carats (10) by the number of milligrams in one carat (200).
→Convert milligrams to grams.

Solution 10(200) = 2,000
2,000 mg = 2 g
A 10-carat precious stone weights 2 g.

60. Strategy To find the number of pieces:
→Convert 75 cm to meters.
→Divide 6 by the length of one piece of material.

Solution 75 cm = 0.75 m
6 ÷ 0.75 = 8
8 pieces of material can be cut from the bolt of material.

61. Strategy To find the length of the walk:
→Add the distances.
→Convert the sum to kilometers.

Solution 1,400 + 1,200 + 1,800 = 4,400
4,400 m = 4.4 km
The walk was 4.4 km.

62. Strategy To find the number of servings:
→Convert 240 ml to liters.
→Divide 2 by the amount of each serving.

Solution 240 ml = 0.24 L
2 ÷ 0.24 ≈ 8.33
The 2-liter bottle will provide 8 servings.

63. Strategy To find the number of liters:
→Convert 800 ml to liters.
→Multiply 30 by the amount of chlorine used each day.

Solution 800 ml = 0.8 L
30(0.8) = 24
The club uses 24 L of chlorine.

64. Strategy To find the cost:
→Multiply the number of bookshelves (4) by the length of each bookshelf (175).
→Convert centimeters to meters.
→Multiply the length in meters by the price per meter (15.75).

Solution 4(175) = 700
700 cm = 7 m
7(15.75) = 110.25
The cost of the shelves is $110.25.

65. Strategy To find the cost:
→Add the weights of the packages.
→Convert grams to kilograms.
→Multiply the sum in kilograms by the price per kilogram (9.89).

Solution $540 + 670 + 890 = 2100$
$2100 \text{ g} = 2.1 \text{ kg}$
$2.1(9.89) \approx 20.77$
The cost of the meat is \$20.77.

66. Strategy To find the number of kilograms:
→Convert 300 g to kilograms.
→Multiply 400 by the amount of fertilizer for each tree.

Solution $300 \text{ g} = 0.3 \text{ kg}$
$400(0.3) = 120$
The orchard requires 120 kg of fertilizer.

67. Strategy To find the number of servings:
→Convert 230 ml to liters.
→Divide 3.78 by the amount of each serving.

Solution $230 \text{ ml} = 0.23 \text{ L}$
$3.78 \div 0.23 \approx 16.43$
The container of milk will provide 16 servings.

68. Strategy To find the number of tablets:
→Convert 500 mg to grams.
→Divide 2 by the amount of calcium in each tablet.

Solution $500 \text{ mg} = 0.5 \text{ g}$
$2 \div 0.5 = 4$
The patient should take 4 tablets per day.

69. Strategy To find the number of grams:
→Convert 1.19 kg to grams.
→Divide the container size by the number of servings.

Solution $1.19 \text{ kg} = 1190 \text{ g}$
$1190 \div 30 \approx 39.67$
One serving contains 40 g.

70. Strategy To find the dimension:
→Convert 274 mm and 156 mm to centimeters.
→Subtract the known dimensions from the total length.

Solution $274 \text{ mm} = 27.4 \text{ cm}$
$156 \text{ mm} = 15.6 \text{ cm}$
$27.4 - (4 + 15.6) = 7.8$
The missing dimension is 7.8 cm.

71. Strategy To find the number of liters:
→Convert 80 ml to liters.
→Multiply the total number of students by the amount of acid for each student.

Solution $80 \text{ ml} = 0.08 \text{ L}$
$30 \cdot 3 \cdot 0.08 = 7.2$
The assistant should order 8 L.

72. Strategy To find which costs less:
→Convert 12 L to milliliters
→Divide price of one-liter bottles by amount.
→Divide price of 24 cans by amount.
→Compare the prices.

Solution $12 \text{ L} = 12{,}000 \text{ ml}$
$19.80 \div 12{,}000 = 0.00165$
$14.50 \div 24 \cdot 340 \approx 0.00178$
$0.00165 < 0.00178$
The case of the 12 one-liter bottles costs less.

73. Strategy

a. To find the amount of mix, convert serving size (31) from grams to kilograms and multiply by the servings per container (6).

b. To find the amount of sodium, convert the sodium (210) from milligrams to grams, and multiply by two.

Solution

a. $31 \text{ g} = 0.031 \text{ kg}$
$0.031 \cdot 6 = 0.186$
There are 0.186 kg of mix.

b. $210 \text{ mg} = 0.21 \text{ g}$
$0.210 \cdot 2 = 0.42$
There is 0.42 g of sodium.

74. Strategy To find the profit:
→Find the number of jars needed by converting 5 L to milliliters, divide the amount by 125 ml.
→To find the total cost, multiply the number of jars by \$0.35 and add to \$99.50.
→To find revenue, multiply number of jars by price per jar.
→To find profit, subtract cost from revenue.

Solution 5 L = 5,000 ml
5,000 ÷ 125 = 40 jars
40 · 0.35 + 99.50 = 113.50
40 · 5.95 = 238
238 – 113.50 = 124.50
The profit is \$124.50.

75. Strategy To find the profit:
→Find the number of bottles needed by converting 5 L to milliliters, divide the amount by 250 ml.
→To find the total cost, multiply the number of bottles by \$0.25 and add \$95.
→To find revenue, multiply number of bottles by price per bottle.
→To find profit, subtract cost from revenue.

Solution 5 L = 5,000 ml
5,000 ÷ 250 = 20 bottles
20 · 0.25 + 95 = 100
20 · 7.89 = 157.80
157.80 – 100 = 57.80
The profit is \$57.80.

76. Strategy To find the profit:
→To find revenue, convert 85 kl to liters and multiply by the price per liter.
→To find profit, subtract cost from revenue.

Solution 85 kl = 85,000 L
85,000 · 0.329 = 27,965
27,965 – 19,250 = 8715
The profit is \$8,715.

77. Strategy To find the profit:
→Find the number of bottles needed by converting 32 kl to liters, divide the amount by 1.25 L.
→To find the total cost, multiply the number of bottles by \$0.21 and add to \$44,480.
→To find revenue, multiply number of bottles by price per bottle.
→To find profit, subtract cost from revenue.

Solution 32 kl = 32,000 L
32,000 ÷ 1.25 = 25,600 bottles
25,600· 0.21 +44,480 = 49,856
25,600 · 2.97 = 76,032
76,032 – 49,856 = 26,176
The profit is \$26,176.

78. Strategy To find the length of column:
→Convert 2.4 m to centimeters.
→Subtract the length of the girder and two plates from 2.4m.

Solution 2.4 m = 240 cm
240 –(22 +1.25 +1.25) = 215.5
The column must be 215.5 cm.

Critical Thinking 7.1, page 426

79. Strategy To find remaining amount:
→Convert 3 L to milliliters
→Subtract 280 ml serving from amount in bottle.
→Convert answer from milliliters to liters.

Solution 3 L = 3,000 ml
3,000 – 280 = 2,720
2,720 ml = 2.72 L
The water that remains is 2,720 ml or 2.72 L.

Section 7.2

Objective A Exercises, pages 429–430

1. $\frac{16\text{ in.}}{24\text{ in.}} = \frac{16}{24} = \frac{2}{3}$
16 in.: 24 in. = 2:3
16 in. TO 24 in. = 2 TO 3

2. $\frac{8\text{ lb}}{60\text{ lb}}=\frac{8}{60}=\frac{2}{15}$
8 lb: 50 lb = 2 :15
8 lb TO 60 lb = 2 TO 15

3. $\frac{9\text{ h}}{24\text{ h}}=\frac{9}{24}=\frac{3}{8}$
9 h: 24 h = 3:8
9 h TO 24 h = 3 TO 8

4. $\frac{\$55}{\$150}=\frac{55}{150}=\frac{11}{30}$
\$55: \$150 = 11:30
\$55 TO \$150 = 11 TO 30

5. $\frac{9\text{ ft}}{2\text{ ft}}=\frac{9}{2}$
9 ft: 2 ft = 9:2
9 ft TO 2 ft = 9 TO 2

6. $\frac{50\text{ min}}{6\text{ min}}=\frac{50}{6}=\frac{25}{3}$
50 min: 6 min = 25:3
50 min TO 6 min = 25 TO 3

7. $\frac{30\text{ ml}}{60\text{ ml}}=\frac{30}{60}=\frac{1}{2}$
30 ml: 60 ml = 1:2
30 ml TO 60 ml = 1 TO 2

8. $\frac{\$1{,}600}{\$600}=\frac{1{,}600}{600}=\frac{8}{3}$

9. $42-3=39$ plays in which no error was made.
$\frac{39\text{ plays}}{42\text{ plays}}=\frac{39}{42}=\frac{13}{14}$

10. $18+8=26$ games
$\frac{18\text{ games}}{26\text{ games}}=\frac{18}{26}=\frac{9}{13}$

11. $\frac{24\text{ teeth}}{36\text{ teeth}}=\frac{24}{36}=\frac{2}{3}$

12. $\frac{\$65}{3\text{ shirts}}$

13. $\frac{150\text{ mi}}{6\text{ h}}=\frac{25\text{ mi}}{1\text{ h}}$

14. $\frac{\$76}{8\text{ h}}=\frac{\$19}{2\text{ h}}$

15. $\frac{\$3.28}{6\text{ bars}}=\frac{\$1.64}{3\text{ bars}}$

16. $\frac{252\text{ trees}}{6\text{ acres}}=\frac{42\text{ trees}}{1\text{ acre}}$

17. $\frac{9\text{ children}}{4\text{ families}}$

18. $\frac{\$460}{40}=\$11.50\text{ / h}$

19. $\frac{\$38{,}700}{12}=\$3{,}225\text{ / month}$

20. $\frac{387.8\text{ mi}}{7\text{ h}}=55.4\text{ mph}$

21. $\frac{364.8}{9.5}=38.4\text{ mi / gal}$

22. $\frac{\$9.54}{4.5\text{ lb}}=\$2.12\text{ / lb}$

23. $\frac{\$3.36}{15\text{ oz}}=\$.224\text{ / oz}$

24. Strategy: To find the ratio, divide the number of rookies (50) by the number of seniors (2,800).

Solution: $\frac{50}{2{,}800}=\frac{1}{50}$
The ratio of rookies to seniors is $\frac{1}{50}$.

25. Strategy: To find the ratio of turns, divide the number of turns in primary coil (40) by the number of turns in the secondary coil (480).

Solution: $\frac{40}{480}=\frac{1}{12}$
The ratio of turns in the primary coil to secondary coil is $\frac{1}{12}$.

26. Strategy To find the rate of travel, substitute 1,155 for d and 2.5 for t in the given equation and solve for r.

Solution $r = \frac{d}{t}$

$r = \frac{1,155}{2.5}$

$r = 462$

The rate of travel for the plane was 462 mph.

27. Strategy To find the ratio of people per square mile, divide each country's population by the area.

Solution $\frac{18,784,000}{2,968,000} \approx 6.329$

$\frac{1.000,849,000}{1,269,000} \approx 788.691$

$\frac{272,640,000}{3,718,000} \approx 73.330$

The ratio for each country is Australia: 6.3 people/mi^2, India: 788.7 people/mi^2, and U.S. 73.3 people/mi^2.

28. Strategy To find the profit per share:
→Subtract the cost (2,500) from the sale price (3,200) to find the profit.
→Divide the profit by the number of shares (100).

Solution $3,200 - 2,500 = 700$

$\frac{700}{100} = 7$

The investor made a profit of \$7 per share.

Critical Thinking 7.2, page 430

29. Strategy To determine eligibility:
→Add the monthly income.
→Add the monthly debt
→Divide the debt by income.
→Compare ratio to 2 to 5.

Solution $3400 + 83 + 640 + 34 = 4517$

$1800+104+27+354+199 = 2484$

$\frac{2484}{4517} = 0.5499$

$\frac{2}{5} = 0.4$

$0.5499 > 0.4$.

No, the homeowner would not qualify.

Section 7.3

Objective A Exercises, page 437

1. $64\text{ in} = \frac{64\text{ in}}{1} \cdot \frac{1\text{ ft}}{12\text{ in}} = 5\frac{1}{3}\text{ ft}$

2. $14\text{ ft} = \frac{14\text{ ft}}{1} \cdot \frac{1\text{ yd}}{3\text{ ft}} = 4\frac{2}{3}\text{ yd}$

3. $42\text{ oz} = \frac{42\text{ oz}}{1} \cdot \frac{1\text{ lb}}{16\text{ oz}} = 2\frac{5}{8}\text{ lb}$

4. $4,400\text{ lb} = \frac{4,400\text{ lb}}{1} \cdot \frac{1\text{ ton}}{2,000\text{ lb}} = 2\frac{1}{5}\text{ ton}$

5. $7,920\text{ ft} = \frac{7,920\text{ ft}}{1} \cdot \frac{1\text{ mi}}{5,280\text{ ft}} = 1\frac{1}{2}\text{ mi}$

6. $42\text{ c} = \frac{42\text{ c}}{1} \cdot \frac{1\text{ qt}}{4\text{ c}} = 10\frac{1}{2}\text{ qt}$

7. $500\text{ lb} = \frac{500\text{ lb}}{1} \cdot \frac{1\text{ ton}}{2,000\text{ lb}} = \frac{1}{4}\text{ ton}$

8. $90\text{ oz} = \frac{90\text{ oz}}{1} \cdot \frac{1\text{ lb}}{16\text{ oz}} = 5\frac{5}{8}\text{ lb}$

9. $10\text{ qt} = \frac{10\text{ qt}}{1} \cdot \frac{1\text{ gal}}{4\text{ qt}} = 2\frac{1}{2}\text{ gal}$

10. $1\frac{1}{4}\text{ lb} = \frac{5\text{ ton}}{4} \cdot \frac{2,000\text{ lb}}{1\text{ ton}} = 2,500\text{ lb}$

11. $2\frac{1}{2}\text{ c}=\frac{5\text{ c}}{2}\cdot\frac{8\text{ fl oz}}{1\text{ c}}=20\text{ fl oz}$

12. $2\frac{5}{8}\text{ lb}=\frac{21\text{ lb}}{8}\cdot\frac{16\text{ oz}}{1\text{ lb}}=42\text{ oz}$

13. $2\frac{1}{4}\text{ mi}=\frac{9\text{ mi}}{4}\cdot\frac{5{,}280\text{ ft}}{1\text{ mi}}=11{,}880\text{ ft}$

14. $17\text{ c}=\frac{17\text{ c}}{1}\cdot\frac{1\text{ qt}}{4\text{ c}}=4\frac{1}{4}\text{ qt}$

15. $7\frac{1}{2}\text{ in}=\frac{15\text{ in}}{2}\cdot\frac{1\text{ ft}}{12\text{ in}}=\frac{5}{8}\text{ ft}$

16. $2\frac{1}{4}\text{ gal}=\frac{9\text{ gal}}{4}\cdot\frac{4\text{ qt}}{1\text{ gal}}=9\text{ qt}$

17. $60\text{ fl oz}=\frac{60\text{ fl oz}}{1}\cdot\frac{1\text{ c}}{8\text{ fl oz}}=7\frac{1}{2}\text{ c}$

18. $1\frac{1}{2}\text{ qt}=\frac{3\text{ qt}}{2}\cdot\frac{4\text{ c}}{1\text{ qt}}=6\text{ c}$

19. $7\frac{1}{2}\text{ pt}=\frac{15\text{ pt}}{2}\cdot\frac{2\text{ c}}{1\text{ pt}}\cdot\frac{1\text{ qt}}{4\text{ c}}=3\frac{3}{4}\text{ qt}$

20. $20\text{ fl oz}=\frac{20\text{ fl oz}}{1}\cdot\frac{1\text{ c}}{8\text{ fl oz}}\cdot\frac{1\text{ pt}}{2\text{ c}}=1\frac{1}{4}\text{ pt}$

21. $1\frac{1}{2}\text{ mi}=\frac{3\text{ mi}}{2}\cdot\frac{5{,}280\text{ ft}}{1\text{ mi}}\cdot\frac{1\text{ yd}}{3\text{ ft}}=2{,}640\text{ yd}$

22. $1\text{ day}=\frac{1\text{ day}}{1}\cdot\frac{24\text{ hr}}{1\text{ day}}\cdot\frac{60\text{ min}}{1\text{ hr}}\cdot\frac{60\text{ s}}{1\text{ min}}$
$= 86{,}400\text{ s}$

Objective B Exercises, pages 437–439

23. $35\text{ yr}=\frac{35\text{ yr}}{1}\cdot\frac{365\text{ day}}{1\text{ yr}}\cdot\frac{24\text{ hr}}{1\text{ day}}\cdot\frac{60\text{ min}}{1\text{ hr}}\cdot\frac{60\text{ s}}{1\text{ min}}$
$= 1{,}103{,}760{,}000\text{ s}$

24. Strategy To find the total cost:
→Convert from feet to yards.
→Multiply the length by the price.

Solution $58\text{ ft}=\frac{58\text{ft}}{1}\cdot\frac{1\text{ yd}}{3\text{ ft}}=19\frac{1}{3}\text{ yd}$

$19\frac{1}{3}\cdot 18=348$

The cost is \$348.

25. Strategy To find the amount of punch:
→Multiply the number of guests (200) by the amount of punch for each guest (1 c) to find the number of cups of punch to be prepared.
→Convert cups to gallons.

Solution $200\cdot 1=200$ cups
200 cups
$=\frac{200\text{ c}}{1}\cdot\frac{1\text{ pt}}{2\text{ c}}\cdot\frac{1\text{ qt}}{2\text{ pt}}\cdot\frac{1\text{ gal}}{4\text{ qt}}=12\frac{1}{2}\text{ gal}$

The guest list would require $12\frac{1}{2}$ gal of punch.

26. Strategy To find the number of quarts:
→Convert from fl oz to quarts.
→Multiply the amount by the number of cans.

Solution 25 fl oz
$=\frac{25\text{ fl oz}}{1}\cdot\frac{1\text{ c}}{8\text{ fl oz}}\cdot\frac{1\text{ qt}}{4\text{ c}}=\frac{25}{32}\text{ qt}$

$\frac{25}{32}\cdot 24=18\frac{3}{4}$

There are $18\frac{3}{4}$ quarts.

27. Strategy To find the number of gallons:
→Convert from quarts to gal.
→Multiply the amount by the number of days and students.

Solution $2\text{ qt}=\frac{2\text{ qt}}{1}\cdot\frac{1\text{ gal}}{4\text{ qt}}=\frac{1}{2}\text{ gal}$

$\frac{1}{2}\cdot 3\cdot 5=7\frac{1}{2}$

They need $7\frac{1}{2}$ gallons of water.

28. Strategy To find the weight:
→Convert from quarts to gal.
→Multiply the amount by the weight.

Solution $5\text{ qt} = \frac{5\text{ qt}}{1} \cdot \frac{1\text{ gal}}{4\text{ qt}} = 1\frac{1}{4}\text{ gal}$

$1\frac{1}{4} \cdot 8\frac{1}{3} = \frac{5}{4} \cdot \frac{25}{3} = 10\frac{5}{12}$

The weight is $10\frac{5}{12}$ lb.

29. Strategy To find the amount of oil left:
→Convert from gallons to qt.
→Multiply the number of oil changes by the amount of oil required for each change.
→Subtract the amount of oil used for oil changes from the amount in the container.

Solution $50\text{ gal} = \frac{50\text{ gal}}{1} \cdot \frac{4\text{ qt}}{1\text{ gal}} = 200\text{ qt}$

$35 \cdot 5 = 175$
$200 - 175 = 25$
There is 25 qt of oil remaining.

30. Strategy To find the speed:
→Convert from feet to mi.
→Convert from seconds to h.

Solution $\frac{1100\text{ ft}}{1\text{ s}} \cdot \frac{60\text{ s}}{1\text{ min}} \cdot \frac{60\text{ min}}{1\text{ h}}$
$= 3{,}960{,}000\text{ ft/h}$

$\frac{3{,}960{,}000\text{ ft}}{\text{h}} \cdot \frac{1\text{ mi}}{5{,}280\text{ ft}} = 750$

The speed is 750 mph.

31. Strategy To find the cost of the carpet:
→Use the formula $A = LW$ to find the area.
→Convert from square feet to square yards.
→Multiply the square yards by \$24/yd^2 to find the cost.

Solution $A = LW = 15\text{ ft} \cdot 20\text{ ft}$
$A = 300\text{ ft}^2$

$300\text{ ft}^2 = \frac{300\text{ ft}^2}{1} \cdot \frac{1\text{ yd}^2}{9\text{ ft}^2} = 33\frac{1}{3}\text{ yd}^2$

$\text{Cost} = \frac{100\text{ yd}^2}{3} \cdot \frac{\$24}{1\text{ yd}^2}$

Cost = \$800
The cost of the carpet is \$800.

32. Strategy To find the cost of the lot:
→Separate the lot into two rectangles.
→Use the formula $A = LW$ to find each area.
→Add the areas together.
→Convert from square feet to acres.
→Multiply the acre by \$20,000 to find the cost.

Solution $A = LW = 170 \cdot 270 = 45{,}900$
$A = LW = 350(350-170) = 63{,}000$
$45{,}900 + 63{,}000 = 108{,}900\text{ ft}^2$

$\frac{108{,}900\text{ ft}^2}{1} \cdot \frac{1\text{ acre}}{43{,}560\text{ ft}^2} = 2.5\text{ acre}$

$2.5 \cdot 20{,}000 = 50{,}000$
The cost of the lot is \$50,000.

33. Strategy To find the cost:
→Convert from acres to ft.
→Multiply lot size by price.

Solution $\frac{1\text{ acre}}{2} \cdot \frac{43{,}560\text{ ft}^2}{1\text{ acre}} = 21{,}780\text{ ft}^2$

$21{,}780 \cdot 3 = 65{,}340$
The cost of the lot is \$65,340.

Objective C Exercises, pages 439–440

34. $100\text{ yd} = \frac{100\text{ yd}}{1} \cdot \frac{1\text{ m}}{1.09\text{ yd}} \approx 91.74\text{ m}$

35. $145\text{ lb} = \frac{145\text{ lb}}{1} \cdot \frac{1\text{ kg}}{2.2\text{ lb}} \approx 65.91\text{ kg}$

36. $5\text{ ft }8\text{ in} = \frac{17\text{ ft}}{3} \cdot \frac{1\text{ m}}{3.28\text{ ft}} \approx 1.73\text{ m}$

37. $2\text{ L} = \frac{2\text{ L}}{1} \cdot \frac{1.06\text{ qt}}{1\text{ L}} \cdot \frac{4\text{ c}}{1\text{ qt}} = 8.48\text{ c}$

38. $15\text{ lb} = \frac{15\text{ lb}}{1} \cdot \frac{1\text{ kg}}{2.2\text{ lb}} \approx 6.82\text{ kg}$

39. $14.3\text{ gal} = \frac{14.3\text{ gal}}{1} \cdot \frac{3.97\text{ L}}{1\text{ gal}} \approx 54.20\text{ L}$

40. $1{,}500\text{ m} = \frac{1{,}500\text{ m}}{1} \cdot \frac{3.28\text{ ft}}{1\text{ m}} = 4{,}920\text{ ft}$

41. $86\text{ kg} = \frac{86\text{ kg}}{1} \cdot \frac{2.2\text{ lb}}{1\text{ kg}} = 189.2\text{ lb}$

42. $6\text{ L} = \frac{6\text{ L}}{1} \cdot \frac{1\text{ gal}}{3.79\text{ L}} \approx 1.58\text{ gal}$

43. $35\text{ mm} = \frac{35\text{ mm}}{1} \cdot \frac{1\text{ cm}}{10\text{ mm}} \cdot \frac{1\text{ in}}{2.54\text{ cm}} \approx 1.38\text{ in}$

44. $327\text{ g} = \frac{327\text{ g}}{1} \cdot \frac{1\text{ oz}}{28.35\text{ g}} \approx 11.53\text{ oz}$

45. $24\text{ L} = \frac{24\text{ L}}{1} \cdot \frac{1\text{ gal}}{3.79\text{ L}} \approx 6.33\text{ gal}$

46. $65\text{mph} = \frac{65\text{ mi}}{1\text{ h}} \cdot \frac{1.61\text{ km}}{1\text{ mi}} = 104.65\text{km/h}$

47. $60\text{ ft/s} = \frac{60\text{ ft}}{1\text{ s}} \cdot \frac{1\text{ m}}{3.28\text{ ft}} \approx 18.29\text{ m/s}$

48. $\$3.49/\text{lb} = \frac{\$3.49}{1\text{ lb}} \cdot \frac{2.2\text{ lb}}{1\text{ kg}} \approx \$7.68/\text{kg}$

49. $\$0.59/\text{lb} = \frac{\$0.59}{1\text{ lb}} \cdot \frac{2.2\text{ lb}}{1\text{ kg}} \approx \$1.30/\text{kg}$

50. $\$24.99/\text{gal} = \frac{\$24.99}{1\text{ gal}} \cdot \frac{1\text{ gal}}{3.79\text{ L}} \approx \$6.59/\text{L}$

51. $80\text{km/h} = \frac{80\text{ km}}{1\text{ h}} \cdot \frac{1\text{ mi}}{1.61\text{ km}} \approx 49.69\text{ mph}$

52. $30\text{m/s} = \frac{30\text{ m}}{1\text{ s}} \cdot \frac{3.28\text{ ft}}{1\text{ m}} = 98.4\text{ ft/s}$

53. $\$0.385/\text{L} = \frac{\$0.385}{1\text{L}} \cdot \frac{3.97\text{ L}}{1\text{ gal}} \approx \$1.46/\text{gal}$

54. Strategy
To find the weight in kg:
→Convert ounces to pounds.
→Add the converted 8 ounces to 51 lb.
→Convert pounds to kilograms.

Solution
$8\text{ oz} = \frac{8\text{ oz}}{1\text{ lb}} \cdot \frac{1\text{ lb}}{16\text{ oz}} = 0.5\text{ lb}$
$51\text{ lb} + 0.5\text{ lb} = 51.5\text{ lb}$
$51.5\text{ lb} = \frac{51.5\text{ lb}}{1} \cdot \frac{1\text{ kg}}{2.2\text{ lb}} \approx 23.4\text{ kg}$
The trout's weight was 23.4 kg.

55. Strategy
To find the distance in kilometers, convert the distance from miles to km.

Solution
24,887 mi
$= \frac{24{,}887\text{ mi}}{1} \cdot \frac{1.61\text{ km}}{1\text{ mi}} = 40{,}068.07\text{ km}$
The distance is 40,068.07 km.

56. Strategy
To find the distance in kilometers, convert the distance from miles to km.

Solution
93,000,000 mi
$= \frac{93{,}000{,}000\text{ mi}}{1} \cdot \frac{1.61\text{ km}}{1\text{ mi}}$
$= 149{,}730{,}000\text{ km}$
The distance is 149,730,000 km.

Critical Thinking 7.3, page 440

57. a. Answers will vary.

b. 2.54 cm/in; 2.2 lb/kg; 1.06 qt/L.

58. **a.** False. 3.79 L ≈ 1 gal.

b. False. 1 m ≈ 1.09 yd.

c. True.

$$30\text{mph} = \frac{30\text{ mi}}{1\text{ h}} \cdot \frac{1.61\text{ km}}{1\text{ mi}} = 48.3\text{km/h}$$

d. True. 1 kg ≈ 2.2 lb.

e. False. 1 oz ≈ 28.35 g.

59. Answers will vary.

60. Answers will vary.

Section 7.4

Objective A Exercises, pages 445–446

1. $$\frac{27}{8} \times \frac{9}{4} \quad \begin{array}{l} \longrightarrow 72 \\ \longrightarrow 108 \end{array}$$
The product of the extremes does not equal the product of the means.
The proportion is not true.

2. $$\frac{3}{18} \times \frac{4}{19} \quad \begin{array}{l} \longrightarrow 72 \\ \longrightarrow 57 \end{array}$$
The product of the extremes does not equal the product of the means.
The proportion is not true.

3. $$\frac{45}{135} \times \frac{3}{9} \quad \begin{array}{l} \longrightarrow 405 \\ \longrightarrow 405 \end{array}$$
The product of the extremes equals the product of the means.
The proportion is true.

4. $$\frac{3}{4} \times \frac{54}{72} \quad \begin{array}{l} \longrightarrow 216 \\ \longrightarrow 216 \end{array}$$
The product of the extremes equals the product of the means.
The proportion is true.

5. $$\frac{16}{3} \times \frac{48}{9} \quad \begin{array}{l} \longrightarrow 144 \\ \longrightarrow 144 \end{array}$$
The product of the extremes equals the product of the means.
The proportion is true.

6. $$\frac{15}{5} \times \frac{3}{1} \quad \begin{array}{l} \longrightarrow 15 \\ \longrightarrow 15 \end{array}$$
The product of the extremes equals the product of the means.
The proportion is true.

7. $$\frac{6\text{ min}}{5\text{ cents}} \times \frac{30\text{ min}}{25\text{ cents}} \quad \begin{array}{l} \longrightarrow 150 \\ \longrightarrow 150 \end{array}$$
The product of the extremes equals the product of the means.
The proportion is true.

8. $$\frac{7\text{ tiles}}{4\text{ ft}} \times \frac{42\text{ tiles}}{20\text{ ft}} \quad \begin{array}{l} \longrightarrow 168 \\ \longrightarrow 140 \end{array}$$
The product of the extremes does not equal the product of the means.
The proportion is not true.

9. $$\frac{15\text{ ft}}{3\text{ yards}} \times \frac{90\text{ ft}}{18\text{ yards}} \quad \begin{array}{l} \longrightarrow 270 \\ \longrightarrow 270 \end{array}$$
The product of the extremes equals the product of the means.
The proportion is true.

10. $$\frac{\$65}{5\text{ days}} \times \frac{\$26}{2\text{ days}} \quad \begin{array}{l} \longrightarrow 130 \\ \longrightarrow 130 \end{array}$$
The product of the extremes equals the product of the means.
The proportion is true.

11. $$\frac{1\text{ gal}}{4\text{ qt}} \times \frac{7\text{ gal}}{28\text{ qt}} \quad \begin{array}{l} \longrightarrow 28 \\ \longrightarrow 28 \end{array}$$
The product of the extremes equals the product of the means.
The proportion is true.

12. $$\frac{300\text{ ft}}{4\text{ rolls}} \times \frac{450\text{ ft}}{7\text{ rolls}} \quad \begin{array}{l} \longrightarrow 1{,}800 \\ \longrightarrow 2{,}100 \end{array}$$
The product of the extremes does not equal the product of the means.
The proportion is not true.

13. $\frac{2}{3} = \frac{n}{15}$
$2 \cdot 15 = 3 \cdot n$
$30 = 3n$
$\frac{30}{3} = \frac{3n}{3}$
$10 = n$

14. $\frac{7}{15} = \frac{n}{15}$
$7 \cdot 15 = 15 \cdot n$
$105 = 15n$
$\frac{105}{15} = \frac{15n}{15}$
$7 = n$

15. $\frac{n}{5} = \frac{12}{25}$
$n \cdot 25 = 5 \cdot 12$
$25n = 60$
$\frac{25n}{25} = \frac{60}{25}$
$n = 2.4$

16. $\frac{n}{8} = \frac{7}{8}$
$n \cdot 8 = 8 \cdot 7$
$8n = 56$
$\frac{8n}{8} = \frac{56}{8}$
$n = 7$

17. $\frac{3}{8} = \frac{n}{12}$
$3 \cdot 12 = 8 \cdot n$
$36 = 8n$
$\frac{36}{8} = \frac{8n}{8}$
$4.5 = n$

18. $\frac{5}{8} = \frac{40}{n}$
$5 \cdot n = 8 \cdot 40$
$5n = 320$
$\frac{5n}{5} = \frac{320}{5}$
$n = 64$

19. $\frac{3}{n} = \frac{7}{40}$
$3 \cdot 40 = n \cdot 7$
$120 = 7n$
$\frac{120}{7} = \frac{7n}{7}$
$17.14 \approx n$

20. $\frac{7}{12} = \frac{25}{n}$
$7 \cdot n = 12 \cdot 25$
$7n = 300$
$\frac{7n}{7} = \frac{300}{7}$
$n \approx 42.86$

21. $\frac{16}{n} = \frac{25}{40}$
$16 \cdot 40 = n \cdot 25$
$640 = 25n$
$\frac{640}{25} = \frac{25n}{25}$
$25.6 = n$

22. $\frac{15}{45} = \frac{72}{n}$
$15 \cdot n = 45 \cdot 72$
$15n = 3{,}240$
$\frac{15n}{15} = \frac{3{,}240}{15}$
$n = 216$

23. $\frac{120}{n} = \frac{144}{25}$
$120 \cdot 25 = n \cdot 144$
$3{,}000 = 144n$
$\frac{3{,}000}{144} = \frac{144n}{144}$
$20.83 \approx n$

24. $\frac{65}{20} = \frac{14}{n}$
$65 \cdot n = 20 \cdot 14$
$65n = 280$
$\frac{65n}{65} = \frac{280}{65}$
$n \approx 4.31$

25. $\frac{0.5}{2.3} = \frac{n}{20}$
$0.5 \cdot 20 = 2.3 \cdot n$
$10 = 23n$
$\frac{10}{2.3} = \frac{2.3n}{2.3}$
$n \approx 4.35$

26. $\frac{1.2}{2.8} = \frac{n}{32}$
$1.2 \cdot 32 = 2.8 \cdot n$
$38.4 = 2.8n$
$\frac{38.4}{2.8} = \frac{2.8n}{2.8}$
$13.71 \approx n$

27. $\frac{0.7}{1.2} = \frac{6.4}{n}$
$0.7 \cdot n = 1.2 \cdot 6.4$
$0.7n = 7.68$
$\frac{0.7n}{0.7} = \frac{7.68}{0.7}$
$n \approx 10.97$

28. $\frac{2.5}{0.6} = \frac{165}{n}$
$2.5 \cdot n = 0.6 \cdot 165$
$2.5n = 99$
$\frac{2.5n}{2.5} = \frac{99}{2.5}$
$n = 39.6$

29. $\frac{x}{6.25} = \frac{16}{87}$
$x \cdot 87 = 6.25 \cdot 16$
$87x = 100$
$\frac{87x}{87} = \frac{100}{87}$
$x \approx 1.15$

30. $\frac{x}{2.54} = \frac{132}{640}$
$x \cdot 640 = 2.54 \cdot 132$
$640x = 335.28$
$\frac{640x}{640} = \frac{335.28}{640}$
$x \approx 0.52$

31. $\frac{1.2}{0.44} = \frac{y}{14.2}$
$1.2 \cdot 14.2 = 0.44 \cdot y$
$17.04 = 0.44y$
$\frac{17.04}{0.44} = \frac{0.44y}{0.44}$
$38.73 \approx y$

32. $\frac{12.5}{y} = \frac{102}{55}$
$12.5 \cdot 55 = y \cdot 102$
$687.5 = 102y$
$\frac{687.5}{102} = \frac{102y}{102}$
$6.74 \approx y$

33. $\frac{n+2}{5} = \frac{1}{2}$
$(n+2)2 = 5 \cdot 1$
$2n + 4 = 5$
$2n = 1$
$\frac{2n}{2} = \frac{1}{2}$
$n = \frac{1}{2} = 0.5$

34. $\frac{5+n}{8} = \frac{3}{4}$
$(5+n)4 = 8 \cdot 3$
$20 + 4n = 24$
$4n = 4$
$\frac{4n}{4} = \frac{4}{4}$
$n = 1$

35. $\frac{4}{3} = \frac{n-2}{6}$
$4 \cdot 6 = 3(n-2)$
$24 = 3n - 6$
$30 = 3n$
$\frac{30}{3} = \frac{3n}{3}$
$10 = n$

36. $\frac{3}{5} = \frac{n-7}{8}$
$3 \cdot 8 = 5(n-7)$
$24 = 5n - 35$
$59 = 5n$
$\frac{59}{5} = \frac{5n}{5}$
$11.8 = n$

37. $\frac{2}{n+3} = \frac{7}{12}$
$2 \cdot 12 = (n+3)(7)$
$24 = 7n + 21$
$3 = 7n$
$\frac{3}{7} = \frac{7n}{7}$
$0.43 \approx n$

38. $\frac{5}{n+1} = \frac{7}{3}$
$5 \cdot 3 = (n+1)7$
$15 = 7n + 7$
$8 = 7n$
$\frac{8}{7} = \frac{7n}{7}$
$1.14 \approx n$

39. $\frac{7}{10} = \frac{3+n}{2}$
$7 \cdot 2 = 10(3+n)$
$14 = 30 + 10n$
$-16 = 10n$
$\frac{-16}{10} = \frac{10n}{10}$
$-1.6 = n$

40. $\frac{3}{2} = \frac{5+n}{4}$
$3 \cdot 4 = 2(5+n)$
$12 = 10 + 2n$
$2 = 2n$
$\frac{2}{2} = \frac{2n}{2}$
$1 = n$

41. $\frac{x-4}{3}=\frac{3}{4}$
$(x-4)4=3\cdot 3$
$4x-16=9$
$4x=25$
$\frac{4x}{4}=\frac{25}{4}$
$x=6.25$

42. $\frac{x-1}{8}=\frac{5}{2}$
$(x-1)2=8\cdot 5$
$2x-2=40$
$2x=42$
$\frac{2x}{2}=\frac{42}{2}$
$x=21$

43. $\frac{6}{1}=\frac{x-2}{5}$
$6\cdot 5=1(x-2)$
$30=x-2$
$32=x$

44. $\frac{7}{3}=\frac{x-4}{8}$
$7\cdot 8=3(x-4)$
$56=3x-12$
$68=3x$
$\frac{68}{3}=\frac{3x}{3}$
$22.67\approx x$

45. $\frac{5}{8}=\frac{2}{x-3}$
$5(x-3)=8\cdot 2$
$5x-15=16$
$5x=31$
$\frac{5x}{5}=\frac{31}{5}$
$x=6.2$

46. $\frac{5}{2}=\frac{1}{x-6}$
$5(x-6)=2\cdot 1$
$5x-30=2$
$5x=32$
$\frac{5x}{5}=\frac{32}{5}$
$x=6.4$

47. $\frac{3}{x-4}=\frac{5}{3}$
$3\cdot 3=(x-4)5$
$9=5x-20$
$29=5x$
$\frac{29}{5}=\frac{5x}{5}$
$5.8=x$

48. $\frac{8}{x-6}=\frac{5}{4}$
$8\cdot 4=(x-6)5$
$32=5x-30$
$62=5x$
$\frac{62}{5}=\frac{5x}{5}$
$12.4=x$

Objective B Exercises, pages 446–448

49. Strategy: To find the length of the amoeba, write and solve a proportion using n to represent the length.

Solution: $\frac{1\text{ in.}}{0.002\text{ in.}}=\frac{2.6\text{ in.}}{n}$
$1\cdot n=0.002\cdot 2.6$
$n=0.0052$
The actual length of the amoeba is 0.0052 in.

50. Strategy: To find the cost, write and solve a proportion using c to represent the cost of the life insurance.

Solution: $\frac{\$5.22}{\$1{,}000}=\frac{c}{\$75{,}000}$
$5.22\cdot 75{,}000=1{,}000\cdot c$
$391{,}500=1{,}000c$
$391.50=c$
The cost of the life insurance is \$391.50.

51. Strategy To find the number of robes, write and solve a proportion using n to represent the number of robes.

Solution $\frac{6 \text{ robes}}{6.5 \text{ yd}} = \frac{n}{26 \text{ yd}}$

$6 \cdot 26 = 6.5n$

$156 = 6.5n$

$\frac{156}{6.5} = \frac{6.5n}{6.5}$

$24 = n$

24 robes can be made.

52. Strategy To find the number of defective disks, write and solve a proportion using n to represent the number of defective disks.

Solution $\frac{3 \text{ defective disks}}{100 \text{ disks}} = \frac{n}{1200 \text{ disks}}$

$3 \cdot 1200 = 100 \cdot n$

$3{,}600 = 100n$

$36 = n$

36 defective disks are expected to be found.

53. Strategy To find the property tax, write and solve a proportion using x to represent the amount of tax.

Solution $\frac{\$4{,}320}{\$90{,}000} = \frac{x}{\$140{,}000}$

$4{,}320 \cdot 140{,}000 = 90{,}000 \cdot x$

$604{,}800{,}000 = 90{,}000x$

$\frac{604{,}800{,}000}{90{,}000} = \frac{90{,}000x}{90{,}000}$

$6{,}720 = x$

The property tax is \$6,720.

54. Strategy To find the dosage, write and solve a proportion using n to represent the amount of medication.

Solution $\frac{2 \text{ mg}}{80 \text{ lb}} = \frac{n}{220 \text{ lb}}$

$2 \cdot 220 = 80 \cdot n$

$440 = 80n$

$\frac{440}{80} = \frac{80n}{80}$

$5.5 = n$

The proper dosage is 5.5 mg.

55. Strategy To find the distance, write and solve a proportion using n to represent the miles driven.

Solution $\frac{84 \text{ mi}}{3 \text{ gal}} = \frac{n}{14.5 \text{ gal}}$

$84 \cdot 14.5 = 3 \cdot n$

$1218 = 3n$

$\frac{1218}{3} = \frac{3n}{3}$

$406 = n$

The car would travel 406 mi on 14.5 gal of gasoline.

56. Strategy To find the number of grams of protein in 454 g of pasta, write and solve a proportion using n to represent the number of grams of protein in 454 g of pasta.

Solution $\frac{7 \text{ g of protein}}{56 \text{ g of pasta}} = \frac{x \text{ g of protein}}{454 \text{ g of pasta}}$

$7 \cdot 454 = 56x$

$3{,}178 = 56x$

$\frac{3{,}178}{56} = \frac{56x}{56}$

$56.75 = x$

There are 56.75 g of protein in 454 g of pasta.

57. Strategy To find the cost of the grapefruit, write and solve a proportion using n to represent the cost of the grapefruit.

Solution $\frac{4 \text{ grapefruit}}{\$.52} = \frac{14 \text{ grapefruit}}{n}$

$4 \cdot n = 0.52 \cdot 14$

$4n = 7.28$

$\frac{4n}{4} = \frac{7.28}{4}$

$n = 1.82$

The cost of 14 grapefruit is \$1.82.

58. Strategy To find the number of rushing yards, write and solve a proportion using n to represent the number of rushing yards.

Solution $\frac{435 \text{ yd}}{5 \text{ games}} = \frac{n}{12 \text{ games}}$

$435 \cdot 12 = 5 \cdot n$

$5{,}220 = 5n$

$\frac{5{,}220}{5} = \frac{5n}{5}$

$1{,}044 = n$

The halfback will rush for 1,044 yd.

59. Strategy To find the number of light fixtures, write and solve a proportion using n to represent the required number of light fixtures.

Solution $\frac{5 \text{ lights}}{400 \text{ ft}^2} = \frac{n}{35{,}000 \text{ ft}^2}$

$5 \cdot 35{,}000 = 400 \cdot n$

$175{,}000 = 400n$

$\frac{175{,}000}{400} = \frac{400n}{400}$

$437.5 = n$

The office will require 438 lights.

60. Strategy To find the number of home runs, write and solve a proportion using n to represent the number of home runs.

Solution $\frac{9 \text{ homes runs}}{32 \text{ games}} = \frac{n}{160 \text{ games}}$

$9 \cdot 160 = 32 \cdot n$

$1{,}440 = 32n$

$\frac{1{,}440}{32} = \frac{32n}{32}$

$45 = n$

The softball player will hit 45 home runs.

61. Strategy To find the time necessary to lose 36 lb, write and solve a proportion using n to represent the time.

Solution $\frac{3 \text{ lb}}{5 \text{ weeks}} = \frac{36 \text{ lb}}{n}$

$3 \cdot n = 5 \cdot 36$

$3n = 180$

$\frac{3n}{3} = \frac{180}{3}$

$n = 60$

The dieter will lose 36 lb in 60 weeks.

62. Strategy To find the cost of the steak, write and solve a proportion using n to represent the cost of the steak.

Solution $\frac{\$12.60}{3 \text{ lb}} = \frac{n}{8 \text{ lb}}$

$12.60 \cdot 8 = 3 \cdot n$

$100.8 = 3n$

$\frac{100.8}{3} = \frac{3n}{3}$

$33.6 = n$

The steak would cost $33.60.

63. Strategy To find the number of defects, write and solve a proportion using n to represent the number of defects.

Solution $\frac{22 \text{ defects}}{1{,}000 \text{ cars}} = \frac{n}{125{,}000 \text{ cars}}$

$22 \cdot 125{,}000 = 1{,}000 \cdot n$

$2{,}750{,}000 = 1{,}000n$

$2{,}750 = n$

There would be 2,750 defects found in the cars.

64. Strategy — To find the number of miles, write and solve a proportion using n to represent the number of miles walked.

Solution

$$\frac{5\text{ mi}}{650\text{ calories}} = \frac{n}{3{,}500\text{ calories}}$$
$$5 \cdot 3{,}500 = 650 \cdot n$$
$$17{,}500 = 650n$$
$$\frac{17{,}500}{650} = \frac{650n}{650}$$
$$26.92 \approx n$$

A person would have to walk approximately 26.92 mi to lose one pound.

65. Strategy — To find the number of miles, write and solve a proportion using n to represent the number of miles.

Solution

3 years is 36 months.

$$\frac{22{,}000\text{ mi}}{4\text{ months}} = \frac{n}{36\text{ months}}$$
$$22{,}000 \cdot 36 = 4 \cdot n$$
$$792{,}000 = 4n$$
$$\frac{792{,}000}{4} = \frac{4n}{4}$$
$$198{,}000 = n$$

The account executive will drive 198,000 mi.

66. Strategy — To find the amount of additional money, write and solve a proportion using x to represent the additional amount of money. Then $1{,}500 + x$ represents the total amount of money.

Solution

$$\frac{\$1{,}500}{\$120} = \frac{1{,}500 + x}{\$300}$$
$$1{,}500 \cdot 300 = 120(1{,}500 + x)$$
$$450{,}000 = 180{,}000 + 120x$$
$$270{,}000 = 120x$$
$$\frac{270{,}000}{120} = \frac{120x}{120}$$
$$2{,}250 = x$$

To earn a dividend of \$300, an additional \$2,250 must be invested.

67. Strategy — To find the additional amount of money, write and solve a proportion using x to represent the additional amount of money. Then $3{,}500 + x$ represents the total amount of money.

Solution

$$\frac{\$3{,}500}{\$280} = \frac{\$3{,}500 + x}{400}$$
$$3{,}500 \cdot 400 = 280(3{,}500 + x)$$
$$1{,}400{,}000 = 980{,}000 + 280x$$
$$420{,}000 = 280x$$
$$\frac{420{,}000}{280} = \frac{280x}{280}$$
$$1{,}500 = x$$

To earn a dividend of \$400, an additional \$1,500 must be invested.

68. Strategy — To find the distance between the two points, write and solve a proportion using n to represent the distance.

Solution

$$\frac{\frac{1}{2}\text{ in.}}{8\text{ mi}} = \frac{1\frac{1}{4}\text{ in.}}{n}$$
$$\frac{1}{2} \cdot n = 8 \cdot 1\frac{1}{4}$$
$$\frac{1}{2}n = 8 \cdot \frac{5}{4}$$
$$\frac{1}{2}n = 10$$
$$\frac{2}{1}\left(\frac{1}{2}n\right) = \frac{2}{1}(10)$$
$$n = 20$$

The distance between the two points is 20 mi.

69. Strategy — To find the number of inches the candle will burn, write and solve a proportion using x to represent the number of inches.

Solution

4 h = 240 min

$$\frac{1.5\text{ in.}}{40\text{ min}} = \frac{x}{240\text{ min}}$$
$$1.5 \cdot 240 = 40 \cdot x$$
$$360 = 40x$$
$$\frac{360}{40} = \frac{40x}{40}$$
$$9 = x$$

The candle will burn 9 in. in 4 h.

70. Strategy To find the amount of salt, write and solve a proportion using n to represent the amount of salt dissolved in the water.

Solution
$$\frac{\frac{2}{3}\text{ lb}}{5\text{ gal}} = \frac{n}{12\text{ gal}}$$
$$\frac{2}{3}(12) = 5 \cdot n$$
$$8 = 5n$$
$$\frac{8}{5} = \frac{5n}{5}$$
$$1.6 = n$$
The salt water solution requires 1.6 lb of salt.

71. Strategy To find the mid-management salary, write and solve a proportion using n to represent the salary.

Solution
$$\frac{7\text{ mid-management}}{5\text{ junior-management}} = \frac{n}{\$45{,}000}$$
$$7 \cdot 45{,}000 = 5 \cdot n$$
$$315{,}000 = 5n$$
$$\frac{315{,}000}{5} = \frac{5n}{5}$$
$$63{,}000 = n$$
The mid-management salary would be \$63,000.

Critical Thinking 7.4, page 448

72. a. $a \div b$ can be written as $\frac{a}{b}$ and is a ratio except when $b = 0$. When $b = 0$, the expression is undefined.

b. $\frac{a}{b} = \frac{c}{d}$, $ad = bc$ by cross multiplication
$\frac{b}{a} = \frac{d}{c}$, $bc = ad$ by cross multiplication
Therefore, if $\frac{a}{b} = \frac{c}{d}$, then $\frac{b}{a} = \frac{d}{c}$ is true.

c. $\frac{a}{c} = \frac{b}{d}$, $ad = bc$ by cross multiplication
Comparing with **b**, we see that if $\frac{a}{b} = \frac{c}{d}$, then $\frac{a}{c} = \frac{b}{d}$ is true.

d. $\frac{a}{d} = \frac{c}{b}$, $ab = dc$ by cross multiplication
Comparing with **b**, we see that if $\frac{a}{b} = \frac{c}{d}$, then $\frac{a}{d} = \frac{c}{b}$ is not true.

73. Yes, Assume that $\frac{a}{b} = \frac{c}{d}$ and that $\frac{a}{b}$ is in simplest form. The proportion $\frac{a}{b} = \frac{a+c}{b+d}$ is true. The numerator and denominator of $\frac{a+c}{b+d}$ have a common factor and the fraction reduces to $\frac{a}{b}$.

For example, $\frac{2}{3} = \frac{8}{12}$, thus $\frac{2}{3} = \frac{2+8}{3+12} = \frac{10}{15} = \frac{5 \cdot 2}{5 \cdot 3} = \frac{2}{3}$.

74. $\frac{a}{b} = \frac{c}{d}$
$\frac{a}{b} + 1 = \frac{c}{d} + 1$
Add 1 to both sides of the equation.
$\frac{a}{b} + \frac{b}{b} = \frac{c}{d} + \frac{d}{d}$
Substitute $\frac{b}{b}$ and $\frac{d}{d}$ for 1.
$\frac{a+b}{b} = \frac{c+d}{d}$
Add the numerators and place over the common denominator.

75. $\frac{2}{3}$ cast a vote in favor of the amendment.
$\frac{3}{4}$ cast a vote against the amendment.
$\frac{2}{5} + \frac{3}{4} = \frac{8}{20} + \frac{15}{20} = \frac{23}{20}$
The number 1 represents the total population. The fraction $\frac{23}{20}$ indicates that there were more votes than voters.

76. a. Let n represent the money represented by 1 part of the circle:
$$\frac{1}{8} = \frac{n}{10{,}000}$$
$$1 \cdot 10{,}000 = 8n$$
$$\$1{,}250 = n$$

b. Let n represent the money represented by 5 parts of the circle:
$$\frac{5}{8} = \frac{n}{10{,}000}$$
$$5 \cdot 10{,}000 = 8n$$
$$\$6{,}250 = n$$

Section 7.5

Objective A Exercises, pages 453–454

3. Strategy: To find the constant of variation, substitute 15 for y and 2 for x in the direct variation equation $y = kx$ and solve for k.

Solution:
$y = kx$
$15 = k \cdot 2$
$\frac{15}{2} = k$
The constant of variation is $\frac{15}{2}$.

4. Strategy: To find the constant of variation, substitute 24 for t and 120 for s in the direct variation equation $t = ks$ and solve for k.

Solution:
$t = ks$
$24 = k \cdot 120$
$\frac{24}{120} = k$
$\frac{1}{5} = k$
The constant of variation is $\frac{1}{5}$.

5. Strategy: To find the constant of variation, substitute 64 for n and 2 for m in the direct variation equation $n = km^2$ and solve for k.

Solution:
$n = km^2$
$64 = k \cdot 2^2$
$64 = 4k$
$\frac{64}{4} = k$
$16 = k$
The constant of variation is 16.

6. Strategy: To find the constant of variation, substitute 30 for y and 3 for x in the direct variation equation $y = kx^2$ and solve for k.

Solution:
$y = kx^2$
$30 = k \cdot 3^2$
$30 = 9k$
$\frac{30}{9} = k$
$\frac{10}{3} = k$
The constant of variation is $\frac{10}{3}$.

7. Strategy: To find P when $R = 6$:
→Write the basic direct variation equation, replace the variables by the given values, and solve for k.
→Write the direct variation equation, replacing k by its value. Substitute 6 for R and solve for P.

Solution:
$P = kR$
$20 = k \cdot 5$
$\frac{20}{5} = k$
$4 = k$
$P = 4R$
$P = 4 \cdot 6$
$P = 24$
The value of P is 24.

8. Strategy: To find T when $S = 2$:
→Write the basic direct variation equation, replace the variables by the given values, and solve for k.
→Write the direct variation equation, replacing k by its value. Substitute 2 for S and solve for T.

Solution:
$T = kS$
$36 = k \cdot 9$
$\frac{36}{9} = k$
$4 = k$
$T = 4S$
$T = 4 \cdot 2$
$T = 8$
The value of T is 8.

9. Strategy

To find M when $P = 20$.

→Write the basic direct variation equation, replace the variables by the given values, and solve for k.

→Write the direct variation equation, replacing k by its value. Substitute 20 for P and solve for M.

Solution

$M = kP$

$15 = k \cdot 30$

$\frac{15}{30} = k$

$\frac{1}{2} = k$

$M = \frac{1}{2}P$

$M = \frac{1}{2} \cdot 20$

$M = 10$

The value of M is 10.

10. Strategy

To find A when $B = 21$:

→Write the basic direct variation equation, replace the variables by the given values, and solve for k.

→Write the direct variation equation, replacing k by its value. Substitute 21 for B and solve for A.

Solution

$A = kB$

$6 = k \cdot 18$

$\frac{6}{18} = k$

$\frac{1}{3} = k$

$A = \frac{1}{3}B$

$A = \frac{1}{3} \cdot 21$

$A = 7$

The value of A is 7.

11. Strategy

To find y when $x = 0.5$:

→Write the basic direct variation equation, replace the variables by the given values, and solve for k.

→Write the direct variation equation, replacing k by its value. Substitute 0.5 for x and solve for y.

Solution

$y = kx^2$

$10 = k \cdot 2^2$

$10 = 4k$

$\frac{5}{2} = k$

$y = \frac{5}{2}x^2$

$y = \frac{5}{2}(0.5)^2$

$y = \frac{5}{2}(0.25)$

$y = 0.625$

The value of y is 0.625.

12. Strategy

To find W when $V = 12$:

→Write the basic direct variation equation, replacing the variables by the given values, and solve for k.

→Write the direct variation equation, replacing k by its value. Substitute 12 for V and solve for W.

Solution

$W = kV^2$

$50 = k \cdot 5^2$

$50 = 25k$

$2 = k$

$W = 2V^2$

$W = 2 \cdot 12^2$

$W = 2(144)$

$W = 288$

The value of W is 288.

13. Strategy To find the amount earned:
→Write the basic direct variation equation, replace the variables by the given values, and solve for k.
→Write the direct variation equation, replacing k by its value. Substitute 30 for h and solve for w.

Solution
$w = kh$
$82 = k \cdot 8$
$\frac{82}{8} = k$
$10.25 = k$
$w = 10.25$
$w = 10.25(30)$
$w = 307.50$
The amount earned is \$307.50.

14. Strategy To find the force:
→Write the basic direct variation equation, replace the variables by the given values, and solve for k.
→Write the direct variation equation, replacing k by its value. Substitute 5 for d and solve for F.

Solution
$d = kF$
$3 = k \cdot 12$
$\frac{3}{12} = k$
$\frac{1}{4} = k$
$d = \frac{1}{4}F$
$5 = \frac{1}{4} \cdot F$
$20 = F$
A force of 20 lb will stretch the spring 5 in.

15. Strategy To find the pressure:
→Write the basic direct variation equation, replace the variables by the given values, and solve for k.
→Write the direct variation equation, replacing k by its value. Substitute 12 for d and solve for P.

Solution
$P = kd$
$2.25 = k \cdot 5$
$\frac{2.25}{5} = k$
$0.45 = k$
$P = 0.45d$
$P = 0.45 \cdot 12$
$P = 5.4$
The pressure is 5.4 lb/in^2 at the depth of 12 ft.

16. Strategy To find the number of words typed:
→Write the basic direct variation equation, replace the variables by the given values, and solve for k.
→Write the direct variation equation, replacing k by its value. Substitute 15 for t and solve for w.

Solution
$w = kt$
$260 = k \cdot 4$
$\frac{260}{4} = k$
$65 = k$
$w = 65t$
$w = 65 \cdot 15$
$w = 975$
The typist types 975 words in 15 min.

17. Strategy To find the stopping distance:
→Write the basic direct variation equation, replace the variables by the given values, and solve for k.
→Write the direct variation equation, replacing k by its value. Substitute 65 for v and solve for s.

Solution
$$s = kv^2$$
$$170 = k \cdot 50^2$$
$$170 = 2{,}500k$$
$$\frac{170}{2{,}500} = k$$
$$\frac{17}{250} = k$$
$$s = \frac{17}{250}v^2$$
$$s = \frac{17}{250}(65)^2$$
$$s = \frac{17}{250} \cdot 4{,}225$$
$$s = 287.3$$
The stopping distance is 287.3 ft.

18. Strategy To find the distance: '
→Write the basic direct variation equation, replace the variables by the given values, and solve for k.
→Write the direct variation equation, replacing k by its value. Substitute 5 for t and solve for d.

Solution
$$d = kt^2$$
$$8 = k(0.5)^2$$
$$8 = 0.25k$$
$$\frac{8}{0.25} = k$$
$$32 = k$$
$$d = 32t^2$$
$$d = 32(5)^2$$
$$d = 32 \cdot 25$$
$$d = 800$$
The object will fall 800 ft in 5 s.

19. Strategy To find the current:
→Write the basic direct variation equation, replace the variables by the given values, and solve for k.
→Write the direct variation equation, replacing k by its value. Substitute 75 for V and solve for I.

Solution
$$I = kV$$
$$4 = k \cdot 100$$
$$\frac{4}{100} = k$$
$$\frac{1}{25} = k$$
$$I = \frac{1}{25}V$$
$$I = \frac{1}{25} \cdot 75$$
$$I = 3$$
The electric current is 3 amps.

20. Strategy To find the time:
→Convert the time (45 min) to hours.
→Write the basic direct variation equation, replace the variables by the given values, and solve for k.
→Write the direct variation equation, replacing k by its value. Substitute 180 for d and solve for t.

Solution
$$45 \text{ min} = \frac{45 \text{ min}}{1} \cdot \frac{1 \text{ h}}{60 \text{ min}}$$
$$= \frac{45}{60}\text{ h} = \frac{3}{4}\text{ h}$$
$$d = kt$$
$$50 = k \cdot \frac{3}{4}$$
$$\frac{4}{3}(50) = k$$
$$\frac{200}{3} = k$$
$$d = \frac{200}{3}t$$
$$180 = \frac{200}{3}t$$
$$\frac{3}{200} \cdot 180 = t$$
$$2.7 = t$$
It takes 2.7 h to travel 180 mi.

Objective B Exercises, pages 454–456

21. Strategy: To find the constant of variation, substitute 10 for y and 5 for x in the inverse variation equation $y=\frac{k}{x}$ and solve for k.

Solution:
$y=\frac{k}{x}$
$10=\frac{k}{5}$
$10\cdot 5=k$
$50=k$
The constant of variation is 50.

22. Strategy: To find the constant of proportionality, substitute 0.2 for T and 8 for S in the inverse variation equation $T=\frac{k}{S}$ and solve for k.

Solution:
$T=\frac{k}{S}$
$0.2=\frac{k}{8}$
$0.2\cdot 8=k$
$1.6=k$
The constant of proportionality is 1.6.

23. Strategy: To find the constant of variation, substitute 4 for p and 5 for q in the inverse variation equation $p=\frac{k}{q^2}$ and solve for k.

Solution:
$p=\frac{k}{q^2}$
$4=\frac{k}{5^2}$
$4=\frac{k}{25}$
$4\cdot 25=k$
$100=k$
The constant of variation is 100.

24. Strategy: To find the constant of variation, substitute 5 for W and 0.5 for V in the inverse variation equation $W=\frac{k}{V^2}$ and solve for k.

Solution:
$W=\frac{k}{V^2}$
$5=\frac{k}{(0.5)^2}$
$5=\frac{k}{0.25}$
$5\cdot 0.25=k$
$1.25=k$
The constant of variation is 1.25.

25. Strategy: To find y when $x=10$:
→Write the basic inverse variation equation, replace the variables by the given values and solve for k.
→Write the inverse variation equation, replacing k by its value. Substitute 10 for x and solve for y.

Solution:
$y=\frac{k}{x}$
$500=\frac{k}{4}$
$500\cdot 4=k$
$2{,}000=k$
$y=\frac{2{,}000}{x}$
$y=\frac{2{,}000}{10}$
$y=200$
The value of y is 200.

26. Strategy To find L when $W = 90$:
→Write the basic inverse variation equation, replace the variables by the given values, and solve for k.
→Write the inverse variation equation, replacing k by its value. Substitute 90 for W and solve for L.

Solution
$$W = \frac{k}{L}$$
$$20 = \frac{k}{12}$$
$$20 \cdot 12 = k$$
$$240 = k$$
$$W = \frac{240}{L}$$
$$90 = \frac{240}{L}$$
$$L = \frac{240}{90}$$
$$L \approx 2.67$$
The value of W is approximately 2.67.

27. Strategy To find y when $x = 10$:
→Write the basic inverse variation equation, replace the variables by the given values, and solve for k.
→Write the inverse variation equation, replacing k by its value. Substitute 10 for x and solve for y.

Solution
$$y = \frac{k}{x^2}$$
$$40 = \frac{k}{4^2}$$
$$40 = \frac{k}{16}$$
$$40 \cdot 16 = k$$
$$640 = k$$
$$y = \frac{640}{x^2}$$
$$y = \frac{640}{10^2}$$
$$y = \frac{640}{100}$$
$$y = 6.4$$
The value of y is 6.4 when $x = 10$.

28. Strategy To find L when $d = 5$:
→Write the basic inverse variation equation, replace the variables by the given values, and solve for k.
→Write the inverse variation equation, replacing k by its value. Substitute 5 for d and solve for L.

Solution
$$L = \frac{k}{d^2}$$
$$25 = \frac{k}{2^2}$$
$$25 = \frac{k}{4}$$
$$25 \cdot 4 = k$$
$$100 = k$$
$$L = \frac{100}{d^2}$$
$$L = \frac{100}{5^2}$$
$$L = \frac{100}{25}$$
$$L = 4$$
The value of L is 4 when $d = 5$.

29. Strategy To find the length of the rectangle:
→Write the basic inverse variation equation, replace the variables by the given values, and solve for k.
→Write the inverse variation equation, replacing k by its value. Substitute 4 for the width and solve for the length.

Solution
$$L = \frac{k}{W}$$
$$8 = \frac{k}{5}$$
$$8 \cdot 5 = k$$
$$40 = k$$
$$L = \frac{40}{W}$$
$$L = \frac{40}{4}$$
$$L = 10$$
The length of the rectangle is 10 ft.

30. Strategy To find the average speed of the return trip:
→Write the basic inverse variation equation, replace the variables by the given values, and solve for k.
→Write the inverse variation equation, replacing k by its value. Substitute 5 for the time and solve for v.

Solution
$t=\frac{k}{v}$
$4=\frac{k}{65}$
$4\cdot 65=k$
$260=k$
$t=\frac{260}{v}$
$5=\frac{260}{v}$
$5v=260$
$v=\frac{260}{5}$
$v=52$
The average speed of the return trip is 52 mph.

31. Strategy To find the resistance in the circuit:
→Write the basic inverse variation equation, replace the variables by the given values, and solve for k.
→Write the inverse variation equation, replacing k by its value. Substitute 1.2 for the current and solve for the resistance.

Solution
$I=\frac{k}{R}$
$0.25=\frac{k}{8}$
$0.25\cdot 8=k$
$2=k$
$I=\frac{2}{R}$
$1.2=\frac{2}{R}$
$1.2R=2$
$R=\frac{2}{1.2}$
$R\approx 1.67$
The resistance is approximately 1.67 ohms.

32. Strategy To find the volume of the gas:
→Write the basic inverse variation equation, replace the variables by the given values, and solve for k.
→Write the inverse variation equation, replacing k by its value. Substitute 4 for the pressure and solve for the volume.

Solution
$V=\frac{k}{P}$
$12=\frac{k}{15}$
$12\cdot 15=k$
$180=k$
$V=\frac{180}{P}$
$V=\frac{180}{4}$
$V=45$
The volume of the gas is 45 ft^3.

33. Strategy To find the number of computers:
→Write the basic inverse variation equation, replace the variables by the given values, and solve for k.
→Write the inverse variation equation, replacing k by its value. Substitute 1,500 for the price and solve for the number of computers sold.

Solution
$S=\frac{k}{P}$
$1,800=\frac{k}{1,800}$
$1,800\cdot 1,800=k$
$3,240,000=k$
$S=\frac{3,240,000}{P}$
$S=\frac{3,240,000}{1,500}$
$S=2,160$
At a price of \$1,500, 2,160 computers can be sold.

34. Strategy To find the number of revolutions per minute:
→Write the basic inverse variation equation, replace the variables by the given values, and solve for k.
→Write the inverse variation equation, replacing k by its value. Substitute 32 for the number of teeth and solve for the number of revolutions per minute.

Solution
$$s=\frac{k}{t}$$
$$15=\frac{k}{40}$$
$$15\cdot 40=k$$
$$600=k$$
$$s=\frac{600}{t}$$
$$s=\frac{600}{32}=18.75$$
The gear will make 18.75 revolutions per minute.

35. Strategy To find the intensity of light:
→Write the basic inverse equation, replace the variables by the given values, and solve for k.
→Write the inverse variation equation, replacing k by its value. Substitute 5 for the distance and solve for the intensity.

Solution
$$I=\frac{k}{d^2}$$
$$20=\frac{k}{8^2}$$
$$20=\frac{k}{64}$$
$$20\cdot 64=k$$
$$1{,}280=k$$
$$I=\frac{1{,}280}{d^2}$$
$$I=\frac{1{,}280}{5^2}$$
$$I=\frac{1{,}280}{25}=51.2$$
The intensity of light is 51.2 lumens.

36. Strategy To find the force:
→Write the basic inverse variation equation, replace the variables by the given values, and solve for k.
→Write the inverse variation equation, replacing k by its value. Substitute 1.2 for the distance and solve for the force.

Solution
$$f=\frac{k}{d^2}$$
$$18=\frac{k}{3^2}$$
$$18=\frac{k}{9}$$
$$18\cdot 9=k$$
$$162=k$$
$$f=\frac{162}{d^2}$$
$$f=\frac{162}{1.2^2}$$
$$f=\frac{162}{1.44}=112.5$$
The force between the magnets is 112.5 lb.

37. Strategy To find the pressure of the gas:
→Write the basic inverse variation equation, replace the variables by the given values, and solve for k.
→Write the inverse variation equation, replacing k by its value. Substitute 150 for the volume and solve for P.

Solution
$$V=\frac{k}{P}$$
$$400=\frac{k}{25}$$
$$25\cdot 400=k$$
$$10{,}000=k$$
$$V=\frac{10{,}000}{P}$$
$$150=\frac{10{,}000}{P}$$
$$P=\frac{10{,}000}{150}\approx 66.67\text{ lb/in}^2$$
The pressure is approximately 66.67 lb/in^2.

38. Strategy To find the number of items:
→Write the basic inverse variation equation, replace the variables by the given values, and solve for k.
→Write the inverse variation equation, replacing k by its value. Substitute 0.20 for the cost and solve for the number of items.

Solution
$$N=\frac{k}{C}$$
$$390=\frac{k}{0.50}$$
$$390\cdot 0.50=k$$
$$195=k$$
$$N=\frac{195}{C}$$
$$N=\frac{195}{0.20}$$
$$N=975$$
When the cost per item is \$.20, 975 items can be purchased.

Critical Thinking 7.5, page 456

39. a. True. Because k is a constant, if x becomes larger, then f becomes larger.

b. False. Rewrite $x=\frac{k}{y}$ as the equivalent expression $xy=k$. If x increases, then y must decrease because the product is a constant.

c. False. If we double s in $T=ks^2$, we obtain $T=k(2s)^2=k\left(4s^2\right)=4ks^2$. Thus if we double s, we quadruple T.

40. Solve by finding the constant of variation.
$$y=kx$$
$$4=k\cdot 10$$
$$\frac{2}{5}=k$$
$$y=\frac{2}{5}x$$
$$y=\frac{2}{5}(15)$$
$$y=6$$

Solve by using a proportion.
Let $x_1=10$, $y_1=4$, and $x_2=15$. Find y_2.
$$\frac{x_1}{y_1}=\frac{x_2}{y_2}$$
$$\frac{10}{4}=\frac{15}{y}$$
$$10y=4\cdot 15$$
$$10y=60$$
$$y=\frac{60}{10}=6$$
Thus a proportion can be used to solve the direct variation problem.

41. a. If we double x in $y=kx^3$, we obtain $y=k(2x)^3=k\left(8x^3\right)=8kx^3$. Thus if we double x, y is 8 times larger.

b. If we double x in $y=\frac{k}{x^3}$, we obtain $y=\frac{k}{(2x)^3}=\frac{k}{8x^3}=\frac{1}{8}\cdot\frac{k}{x^3}$. Thus if we double x, y is $\frac{1}{8}$ as large.

Chapter Review Exercises, pages 461–462

1. 1.25 km = 1,250 m
2. 0.450 g = 450 mg
3. $\frac{100\text{ lb}}{100\text{ lb}}=\frac{1}{1}$, 1 : 1, 1 TO 1
4. $\frac{18\text{ roof supports}}{9\text{ ft}}=\frac{6\text{ roof supports}}{3\text{ ft}}$
5. $\frac{\$314}{40\text{ h}}=\$7.85/\text{h}$
6. $\frac{8\text{ h}}{15\text{ h}}=\frac{8}{15}$
7. $96\text{ in}=\frac{96\text{ in}}{1}\cdot\frac{1\text{ ft}}{12\text{ in}}\cdot\frac{1\text{ yd}}{3\text{ ft}}=2\frac{2}{3}\text{ yd}$

8. $72\text{ oz} = \frac{72\text{ oz}}{1} \cdot \frac{1\text{ lb}}{16\text{ oz}} = 4\frac{1}{4}\text{ lb}$

9. $36\text{ fl oz} = \frac{36\text{ fl oz}}{1} \cdot \frac{1\text{ c}}{8\text{ fl oz}} = 4\frac{1}{2}\text{ c}$

10. $1\frac{1}{4}\text{ mi} = \frac{5\text{ mi}}{4} \cdot \frac{5{,}280\text{ ft}}{1\text{ mi}} = 6{,}600\text{ ft}$

11. $\frac{n}{3} = \frac{8}{15}$

$n \cdot 15 = 3 \cdot 8$

$15n = 24$

$n = \frac{24}{15}$

$n = 1.6$

12. $\frac{15\text{ lb}}{12\text{ trees}} = \frac{5\text{ lb}}{4\text{ trees}}$

13. $\frac{171\text{ mi}}{3\text{ h}} = 57\text{ mph}$

14. $\frac{2}{3.5} = \frac{n}{12}$

$2 \cdot 12 = 3.5 \cdot n$

$24 = 3.5n$

$\frac{24}{3.5} = n$

$6.86 \approx n$

15. $1\text{ qt} = \frac{1\text{ qt}}{1} \cdot \frac{1\text{ L}}{1.06\text{ qt}} \cdot \frac{1000\text{ ml}}{1\text{ L}} \approx 943.40\text{ ml}$

16. $29\text{ ft} = \frac{29\text{ ft}}{1} \cdot \frac{1\text{ m}}{3.28\text{ ft}} \approx 8.84\text{ m}$

17. $100\text{ m} = \frac{100\text{ m}}{1} \cdot \frac{3.28\text{ ft}}{1\text{ m}} = 328\text{ ft}$

18. $2.1\text{ kg} = \frac{2.1\text{ kg}}{1} \cdot \frac{2.2\text{ lb}}{1\text{ kg}} = 4.62\text{ lb}$

19. $30\text{ mph} = \frac{30\text{ mi}}{1\text{ h}} \cdot \frac{1.61\text{ km}}{1\text{ mi}} = 48.3\text{ km/h}$

20. $75\text{ km/h} = \frac{75\text{ km}}{1\text{ h}} \cdot \frac{1\text{ mi}}{1.61\text{ km}} \approx 46.58\text{ mph}$

21. $\frac{18\text{ c}}{24\text{ pt}} = \frac{3\text{ c}}{4\text{ pt}}$

22. Strategy: To find the constant of variation, substitute 10 for y and 30 for x in the direct variation equation $y = kx$ and solve for k.

Solution:

$y = kx$

$10 = k \cdot 30$

$\frac{10}{30} = k$

$\frac{1}{3} = k$

The constant of variation is $\frac{1}{3}$.

23. Strategy: To find T when $S = 120$:

→Write the basic direct variation equation, replace the variables by the given values, and solve for k.

→Write the direct variation equation, replacing k by its value. Substitute 120 for S and solve for T.

Solution:

$T = kS^2$

$50 = k \cdot 5^2$

$50 = 25k$

$\frac{50}{25} = k$

$2 = k$

$T = 2S^2$

$T = 2 \cdot 120^2$

$T = 2 \cdot 14{,}400 = 28{,}800$

$T = 28{,}800$

The value of T is 28,800.

24. Strategy To find y when $x = 25$:
→Write the inverse variation equation, replace the variables by the given values and solve for k.
→Write the inverse variation equation, replacing k by its value. Substitute 25 for x and solve for y.

Solution $y = \frac{k}{x}$
$0.2 = \frac{k}{5}$
$0.2 \cdot 5 = k$
$1 = k$
$y = \frac{1}{x}$
$y = \frac{1}{25}$
The value of y is $\frac{1}{25}$.

25. Strategy To find the number of pieces:
→Convert 1.21 m to cm.
→Add the distances.

Solution 1.21 m = 121 cm
$42 + 18 + 121 = 181$
The total length of the shaft is 181 cm.

26. Strategy To find the ratio:
→Subtract the present price (75) from the original price (125).
→Form the ratio of the decrease in price to the original price (125).

Solution $125 - 75 = 50$
$\frac{\$50}{\$125} = \frac{2}{5}$
The ratio of the decrease in price to the original price is $\frac{2}{5}$.

27. Strategy To find the number of ounces:
→Convert 12 lb to ounces.
→Divide the amount by 16.

Solution $12 \text{ lb} = \frac{12 \text{ lb}}{1} \cdot \frac{16 \text{ oz}}{1 \text{ lb}} = 192 \text{ oz}$
$192 \div 16 = 12$
Each container has 12 oz of hamburger meat.

28. Strategy To find the amount invested, write and solve for proportion using n to represent the amount of money invested.

Solution $\frac{8{,}000}{520} = \frac{n}{780}$
$8{,}000 \cdot 780 = 520 \cdot n$
$6{,}240{,}000 = 520n$
$\frac{6{,}240{,}000}{520} = n$
$12{,}000 = n$
The amount of money invested is \$12,000.

29. Strategy To find the distance:
→Write the basic direct variation equation, replace the variables by the given values, and solve for k.
→Write the direct variation equation, replacing k by its value. Substitute 28 for the weight and solve for the distance.

Solution $d = kw$
$2 = k \cdot 5$
$\frac{2}{5} = k$
$d = \frac{2}{5}w$
$d = \frac{2}{5} \cdot 28$
$d = 11.2$
The weight will stretch the spring 11.2 in.

30. Strategy To find the amount of plant food, write and solve a proportion using n to represent the amount of plant food.

Solution $\frac{0.5}{50} = \frac{n}{275}$
$0.5 \cdot 275 = 50 \cdot n$
$137.5 = 50n$
$\frac{137.5}{50} = n$
$2.75 = n$
2.75 lb of plant food should be used.

31. Strategy To convert mph to ft per sec, use the conversion factors $\frac{1 \text{ h}}{3,600 \text{ s}}$ and $\frac{5,280 \text{ ft}}{1 \text{ mi}}$.

Solution 87 mph
$= \frac{87 \text{ mi}}{1 \text{ h}} \cdot \frac{1 \text{ h}}{3,600 \text{ s}} \cdot \frac{5,280 \text{ ft}}{1 \text{ mi}}$
$= 127.6$ ft/s
The speed is 127.6 ft/s.

32. Strategy To find the volume:
→Write the basic inverse variation equation, replace the variables by the given values, and solve for k.
→Write the inverse variation equation, replacing k by its value. Substitute 12 for P and solve for V.

Solution $V = \frac{k}{P}$
$2.5 = \frac{k}{6}$
$2.5 \cdot 6 = k$
$15 = k$
$V = \frac{15}{P}$
$V = \frac{15}{12}$
$V = 1.25$
The volume of the balloon is 1.25ft^3.

33. Strategy To find the amount the other attorney receives, write and solve a proportion using n to represent the amount.

Solution $\frac{3}{2} = \frac{96,000}{n}$
$3 \cdot n = 2 \cdot 96,000$
$3n = 192,000$
$\frac{3n}{3} = \frac{192,000}{3}$
$n = 64,000$
The attorney receives $64,000.

Chapter Test, pages 463–464

1. 4,650 cm = 46.5 m
2. 4.1 L = 4,100 ml
3. $\frac{3 \text{ yd}}{24 \text{ yd}} = \frac{1}{8}$, 1 : 8, 1 TO 8
4. $\frac{16 \text{ oz}}{64 \text{ cookies}} = \frac{1 oz}{4 \text{ cookies}}$
5. $\frac{120 \text{ mi}}{200 \text{ min}} = 0.6 \text{ mi/min}$
6. $\frac{200 \text{ ft}}{100 \text{ ft}} = \frac{2}{1}$
7. $2\frac{3}{5} \text{ tons} = \frac{13 \text{ tons}}{5} \cdot \frac{2,000 \text{ lb}}{1 \text{ ton}} = 5,200 \text{ lb}$
8. $2\frac{1}{2} \text{ c} = \frac{5 \text{ c}}{2} \cdot \frac{8 \text{ fl oz}}{1 \text{ c}} = 20 \text{ fl oz}$
9. $3\frac{1}{4} \text{ lb} = \frac{13 \text{ lb}}{4} \cdot \frac{16 \text{ oz}}{1 \text{ lb}} = 52 \text{ oz}$
10. $8\frac{1}{2} \text{ ft} = \frac{17 \text{ ft}}{2} \cdot \frac{12 \text{ in}}{1 \text{ ft}} = 102 \text{ in}$
11. $\frac{n}{5} = \frac{3}{20}$
$n \cdot 20 = 5 \cdot 3$
$20n = 15$
$n = \frac{15}{20}$
$n = 0.75$

12. $\frac{8\text{ ft}}{4\text{ s}} = 2\text{ ft/s}$

13. $4.3\text{ c} = \frac{4.3\text{ c}}{1} \cdot \frac{8\text{ oz}}{1\text{ c}} = 34.4\text{ oz}$

14. $42\text{ yd} = \frac{42\text{ yd}}{1} \cdot \frac{3\text{ ft}}{1\text{ yd}} = 126\text{ ft}$

15. $\frac{2{,}860\text{ ft}^2}{6\text{ h}} = 476.67\text{ ft}^2/\text{h}$

16. $\frac{n}{4} = \frac{8}{9}$
$n \cdot 9 = 4 \cdot 8$
$9n = 32$
$\frac{9n}{9} = \frac{32}{9}$
$n \approx 3.56$

17. $12\text{ oz} = \frac{12\text{ oz}}{1} \cdot \frac{28.35\text{g}}{1\text{ oz}} = 340.2\text{ g}$

18. $547\text{ ft} = \frac{547\text{ ft}}{1} \cdot \frac{1\text{ m}}{3.28\text{ ft}} \approx 166.77\text{ m}$

19. $1{,}000\text{ m} = \frac{1{,}000\text{ m}}{1} \cdot \frac{1.09\text{ yd}}{1\text{ m}} = 1{,}090\text{ yd}$

20. $1.9\text{ kg} = \frac{1.9\text{ kg}}{1} \cdot \frac{2.2\text{ lb}}{1\text{kg}} = 4.18\text{ lb}$

21. $35\text{ mph} = \frac{35\text{ mi}}{1\text{ h}} \cdot \frac{1.61\text{ km}}{1\text{ mi}} = 56.35\text{ km/h}$

22. $60\text{ km/h} = \frac{60\text{ km}}{1\text{ h}} \cdot \frac{1\text{ mi}}{1.61\text{ km}} \approx 37.27\text{ mph}$

23. Strategy To find the constant of proportionality, substitute 10 for y and 2 for x in the inverse variation equation $y = \frac{k}{x}$ and solve for k.

Solution $y = \frac{k}{x}$
$10 = \frac{k}{2}$
$10 \cdot 2 = k$
$20 = k$
The constant of proportionality is 20.

24. Strategy To find P when $R = 15$:
→Write the basic direct variation equation, replace the variables by the given values, and solve for k.
→Write the direct variation equation, replacing k by its value. Substitute 15 for R and solve for P.

Solution $R = kP$
$4 = k \cdot 20$
$\frac{4}{20} = k$
$\frac{1}{5} = k$
$R = \frac{1}{5}P$
$15 = \frac{1}{5}P$
$5 \cdot 15 = P$
$75 = P$
The value of P is 75.

25. Strategy To find U when $V = 2$:
→Write the inverse variation equation, replace the variables by the given values, and solve for k.
→Write the inverse variation equation, replacing k by its value. Substitute 2 for V and solve for U.

Solution
$$U = \frac{k}{V^2}$$
$$20 = \frac{k}{4^2}$$
$$20 = \frac{k}{16}$$
$$20 \cdot 16 = k$$
$$320 = k$$
$$U = \frac{320}{V^2}$$
$$U = \frac{320}{2^2}$$
$$U = \frac{320}{4} = 80$$
The value of U is 80.

26. Strategy To find the ratio, form the ratio of the original weight (165) to the increased weight (190).

Solution
$$\frac{165}{190} = \frac{33}{38}$$
The ratio of the original weight to the increased weight is $\frac{33}{38}$.

27. Strategy To find the sales tax, write and solve a proportion using x to represent the amount of tax.

Solution
$$\frac{\$7.60}{\$95} = \frac{x}{\$19{,}600}$$
$$7.60 \cdot 19{,}600 = 95 \cdot x$$
$$148{,}960 = 95x$$
$$\frac{148{,}960}{95} = \frac{95x}{95}$$
$$1{,}568 = x$$
The sales tax is \$1,568.

28. Strategy To find the number of registered voters that would vote, write and solve a proportion using n to represent the number of people that would vote.

Solution
$$\frac{3}{4} = \frac{n}{325{,}000}$$
$$3 \cdot 325{,}000 = 4n$$
$$975{,}000 = 4n$$
$$\frac{975{,}000}{4} = n$$
$$243{,}750 = n$$
243,750 of the registered voters would vote.

29. Strategy To find the difference:
→Convert from lb to ounces.
→Divide the amount of cheese by the package size.
→To find the selling price, multiply the number of packages by price (5).
→Subtract the purchase price from the selling price.

Solution
$$24\text{ lb} = \frac{24\text{ lb}}{1} \cdot \frac{16\text{ oz}}{1\text{ lb}} = 384\text{ oz}$$
$$\frac{384}{12} = 32$$
$$32 \cdot 5 = 160$$
$$160 - 84 = 76$$
The difference is \$76.

30. Strategy To find the length of the room, write and solve a proportion using n to represent the length.

Solution
$$\frac{4}{1} = \frac{n}{12\frac{1}{2}}$$
$$4 \cdot \frac{25}{2} = 1 \cdot n$$
$$50 = n$$
The length of the room is 50 ft.

31. Strategy To convert mph to ft per sec, use the conversion factors $\frac{1\text{ h}}{3{,}600\text{ s}}$ and $\frac{5{,}280\text{ ft}}{1\text{ mi}}$.

Solution 52 mph

$$= \frac{52\text{ mi}}{1\text{ h}} \cdot \frac{1\text{ h}}{3{,}600\text{ s}} \cdot \frac{5{,}280\text{ ft}}{1\text{ mi}}$$

$= 76.27$ ft/s

The speed is 76.27 ft/s.

32. Strategy To find the stopping distance:

→Write the basic direct variation equation, replace the variables by the given values, and solve for k.

→Write the direct variation equation, replacing k by its value. Substitute 60 for v and solve for d

Solution

$$d = kv^2$$
$$130 = k \cdot 40^2$$
$$130 = 1{,}600k$$
$$\frac{130}{1{,}600} = k$$
$$d = \frac{13}{160}v^2$$
$$d = \frac{13}{160} \cdot 60^2$$
$$d = \frac{13}{160} \cdot 3{,}600$$
$$d = 292.5$$

The stopping distance of the car is 292.5 ft.

33. Strategy To find the number of revolutions per minute:

→Write the basic inverse variation equation, replace the variables by the given values, and solve for k.

→Write the inverse variation equation, replacing k by its value. Substitute 40 for the number of teeth and solve for the number of revolutions per minute.

Solution

$$s = \frac{k}{t}$$
$$160 = \frac{k}{25}$$
$$160 \cdot 25 = k$$
$$4{,}000 = k$$
$$s = \frac{4{,}000}{t}$$
$$s = \frac{4000}{40} = 100$$

The gear will make 100 revolutions per minute.

Cumulative Review Exercises, pages 465–466

1. $18 \div \frac{6-3}{9} - (-3)$

$= 18 \div \frac{3}{9} - (-3)$

$= 18 \div \frac{1}{3} - (-3)$

$= 18 \cdot \frac{3}{1} - (-3)$

$= 54 - (-3)$

$= 54 + 3$

$= 57$

2. $1.2 \text{ gal} = 1.2 \text{ gal} \cdot \frac{4 \text{ qt}}{1 \text{ gal}}$

$= 4.8$ qt

3. $7\frac{5}{12} - 3\frac{5}{9} = 7\frac{15}{36} - 3\frac{20}{36}$

$= 6\frac{51}{36} - 3\frac{20}{36}$

$= 3\frac{31}{36}$

4. $\frac{4}{5}\div\frac{4}{5}+\frac{2}{3}=\frac{4}{5}\cdot\frac{5}{4}+\frac{2}{3}$
$=1+\frac{2}{3}$
$=1\frac{2}{3}$

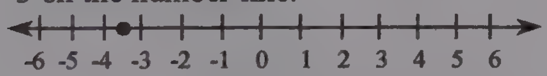
5. $342\div(-3)=-114$

6. $2a-3ab$
$2(2)-3(2)(-3)$
$=4-3(2)(-3)$
$=4-6(-3)$
$=4-(-18)$
$=4+18$
$=22$

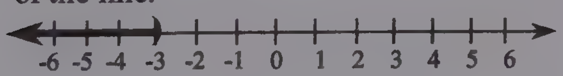
7. $5x-20=0$
$5x-20+20=0+20$
$5x=20$
$\frac{5x}{5}=\frac{20}{5}$
$x=4$
The solution is 4.

8. $3(x-4)+2x=3$
$3x-12+2x=3$
$5x-12=3$
$5x-12+12=3+12$
$5x=15$
$\frac{5x}{5}=\frac{15}{5}$
$x=3$
The solution is 3.

9. Draw a solid dot one half unit to the left of -3 on the number line.



10. Draw a parenthesis at -3. Draw a line to the left of -3. Draw an arrow at the left end of the line.



11. $(-5)^2-(-8)\div(7-5)^2\cdot 2-8$
$=(-5)^2-(-8)\div 2^2\cdot 2-8$
$=25-(-8)\div 4\cdot 2-8$
$=25-(-2)\cdot 2-8$
$=25-(-4)-8$
$=25+4-8$
$=29-8$
$=21$

12. $\left(-\frac{2}{3}\right)\left(-\frac{3}{4}\right)^2=\left(-\frac{2}{3}\right)\left(\frac{9}{16}\right)$
$=-\frac{2}{3}\cdot\frac{9}{16}$
$=-\frac{2\cdot 9}{3\cdot 16}$
$=-\frac{2\cdot 3\cdot 3}{3\cdot 2\cdot 2\cdot 2\cdot 2}$
$=-\frac{3}{8}$

13. $\sqrt{169}=13$

14. $5-2(1-3a)+2(a-3)$
$=5-2+6a+2a-6$
$=8a-3$

15. $(4a^3b)(-5a^2b^3)=[4(-5)](a^3a^2)(bb^3)$
$=-20a^5b^4$

16. $-3y^2+3y-y^2-6y$
$=(-3y^2-y^2)+(3y-6y)$
$=-4^2-3y$

17. $y=3x-2$
$y=3(-1)-2$
$y=-3-2$
$y=-5$
The ordered pair solution is $(-1,-5)$.

18. $\frac{30\text{ cents}}{1\text{ dollar}}=\frac{30\text{ cents}}{100\text{ cents}}=\frac{3}{10}$

19. $\frac{\$9{,}425}{5\text{ months}}=\$1{,}885/\text{month}$

20. $\$1.47/\text{gal}=\frac{\$1.47}{1\text{gal}}\cdot\frac{1\text{gal}}{3.79\text{L}}\approx\$0.39/\text{L}$

21. $\frac{2}{3}=\frac{n}{48}$
$2\cdot 48=3\cdot n$
$96=3n$
$\frac{96}{3}=n$
$32=n$

22. $\dfrac{\frac{1}{2}+\frac{3}{4}}{2-\frac{5}{8}}=\dfrac{\frac{2}{4}+\frac{3}{4}}{\frac{16}{8}-\frac{5}{8}}$

$=\dfrac{\frac{5}{4}}{\frac{11}{8}}$

$=\frac{5}{4}\div\frac{11}{8}$

$=\frac{5}{4}\cdot\frac{8}{11}$

$=\frac{5\cdot 8}{4\cdot 11}$

$=\frac{5\cdot 2\cdot 2\cdot 2}{2\cdot 2\cdot 11}=\frac{10}{11}$

23. $-2\sqrt{x^2-3y}$

$-2\sqrt{4^2-3(-3)}$

$=-2\sqrt{16-(-9)}$

$=-2\sqrt{16+9}$

$=-2\sqrt{25}$

$=-2\cdot 5=-10$

24. $3x+3(x+4)=4(x+2)$

$3x+3x+12=4x+8$

$6x+12=4x+8$

$6x-4x+12=4x-4x+8$

$2x+12=8$

$2x+12-12=8-12$

$2x=-4$

$\frac{2x}{2}=\frac{-4}{2}$

$x=-2$

The solution is –2.

25. Strategy To find the monthly difference:
→Find the difference in annual expenses between the northeast (587) and south (243).
→Convert the difference from annual to monthly by dividing by 12.

Solution $587-243=344$

$344\div 12\approx 28.67$

The monthly difference is \$28.67.

26. The unknown number: x

five less than two thirds of a number	is	three

$\frac{2}{3}x-5=3$

$\frac{2}{3}x-5+5=3+5$

$\frac{2}{3}x=8$

$\frac{3}{2}\left(\frac{2}{3}x\right)=\frac{3}{2}\cdot 8$

$x=12$

The number is 12.

27. Let the number be x.

The difference between four times a number and three times the sum of the number and two.

$4x-3(x+2)$

$4x-3x-6$

$x-6$

28. Strategy To find the number of miles left to drive:
→Find the number of miles already driven by subtracting the original odometer reading (18,325) from the present odometer reading (18,386).
→Subtract the number of miles already drive from 125.

Solution

$$\begin{array}{r} 18{,}386 \\ -\,18{,}325 \\ \hline 61 \end{array}$$

$$\begin{array}{r} 125 \\ -\,61 \\ \hline 64 \end{array}$$

You have 64 mi left to drive.

29. Strategy To find the new checking balance:
→Add the deposit (122.35) to the checking account balance (422.89).
→Subtract the check (279.76) from the new checking account balance.

Solution
$$\begin{array}{r} 422.89 \\ +122.35 \\ \hline 545.24 \end{array}$$
$$\begin{array}{r} 545.24 \\ -279.76 \\ \hline 265.48 \end{array}$$
The new checking account balance is \$265.48.

30. Strategy To find the part that remains to be completed:
→Add the amount already done $\left(\frac{2}{5}+\frac{1}{3}\right)$.
→Subtract the amounts already done from the total job (1).

Solution $\frac{2}{5}+\frac{1}{3}=\frac{6}{15}+\frac{5}{15}=\frac{11}{15}$
$1-\frac{11}{15}=\frac{15}{15}-\frac{11}{15}=\frac{4}{15}$
$\frac{4}{15}$ of the job remains to be done.

31. Strategy To find the number of votes cast, multiply the number of registered voters (31,281) by the fraction of those who voted $\left(\frac{2}{3}\right)$.

Solution $31,281\cdot\frac{2}{3}=\frac{31,281\cdot 2}{3}$
$=20,854$
In the city election 20,854 votes were cast.

32. Strategy To find the number of miles driven per gallon, divide the number of miles driven (402.5) by the number of gallons of gas used (11.5).

Solution $\frac{402.5}{11.5}=35$
The car travels 35 mi on each gallon of gas.

33. Strategy To find the rpm in third gear, write and solve an equation using n to represent the rpm in third gear.

Solution $\boxed{\frac{2}{3}\text{ of the rpm in third gear}}$ is $\boxed{2,500}$
$\frac{2}{3}n=2,500$
$\frac{3}{2}\left(\frac{2}{3}n\right)=\frac{3}{2}(2,500)$
$n=3,750$
The rpm of the engine is 3,750 in third gear.

Chapter 8

Section 8.1

Objective A Exercises, page 741

3. $5\% = 5\left(\frac{1}{100}\right) = \frac{5}{100} = \frac{1}{20}$
   $5\% = 5(0.01) = 0.05$

4. $60\% = 60\left(\frac{1}{100}\right) = \frac{60}{100} = \frac{3}{5}$
   $60\% = 60(0.01) = 0.60$

5. $30\% = 30\left(\frac{1}{100}\right) = \frac{30}{100} = \frac{3}{10}$
   $30\% = 30(0.01) = 0.30$

6. $90\% = 90\left(\frac{1}{100}\right) = \frac{90}{100} = \frac{9}{10}$
   $90\% = 90(0.01) = 0.90$

7. $250\% = 250\left(\frac{1}{100}\right) = \frac{250}{100} = \frac{5}{2}$
   $250\% = 250(0.01) = 2.50$

8. $140\% = 140\left(\frac{1}{100}\right) = \frac{140}{100} = \frac{7}{5}$
   $140\% = 140(0.01) = 1.40$

9. $28\% = 28\left(\frac{1}{100}\right) = \frac{28}{100} = \frac{7}{25}$
   $28\% = 28(0.01) = 0.28$

10. $66\% = 66\left(\frac{1}{100}\right) = \frac{66}{100} = \frac{33}{50}$
    $66\% = 66(0.01) = 0.66$

11. $35\% = 35\left(\frac{1}{100}\right) = \frac{35}{100} = \frac{7}{20}$
    $35\% = 35(0.01) = 0.35$

12. $8\% = 8\left(\frac{1}{100}\right) = \frac{8}{100} = \frac{2}{25}$
    $8\% = 8(0.01) = 0.08$

13. $29\% = 29\left(\frac{1}{100}\right) = \frac{29}{100}$
    $29\% = 29(0.01) = 0.29$

14. $83\% = 83\left(\frac{1}{100}\right) = \frac{83}{100}$
    $83\% = 83(0.01) = 0.83$

15. $11\frac{1}{9}\% = 11\frac{1}{9}\left(\frac{1}{100}\right) = \frac{100}{9}\left(\frac{1}{100}\right) = \frac{1}{9}$

16. $12\frac{1}{2}\% = 12\frac{1}{2}\left(\frac{1}{100}\right) = \frac{25}{2}\left(\frac{1}{100}\right) = \frac{1}{8}$

17. $37\frac{1}{2}\% = 37\frac{1}{2}\left(\frac{1}{100}\right) = \frac{75}{2}\left(\frac{1}{100}\right) = \frac{3}{8}$

18. $31\frac{1}{4}\% = 31\frac{1}{4}\left(\frac{1}{100}\right) = \frac{125}{4}\left(\frac{1}{100}\right) = \frac{5}{16}$

19. $66\frac{2}{3}\% = 66\frac{2}{3}\left(\frac{1}{100}\right) = \frac{200}{3}\left(\frac{1}{100}\right) = \frac{2}{3}$

20. $45\frac{5}{11}\% = 45\frac{5}{11}\left(\frac{1}{100}\right) = \frac{500}{11}\left(\frac{1}{100}\right) = \frac{5}{11}$

21. $6\frac{2}{3}\% = 6\frac{2}{3}\left(\frac{1}{100}\right) = \frac{20}{3}\left(\frac{1}{100}\right) = \frac{1}{15}$

22. $68\frac{3}{4}\% = 68\frac{3}{4}\left(\frac{1}{100}\right) = \frac{275}{4}\left(\frac{1}{100}\right) = \frac{11}{16}$

23. $\frac{1}{2}\% = \frac{1}{2}\left(\frac{1}{100}\right) = \frac{1}{200}$

24. $83\frac{1}{3}\% = 83\frac{1}{3}\left(\frac{1}{100}\right) = \frac{250}{3}\left(\frac{1}{100}\right) = \frac{5}{6}$

25. $6\frac{1}{4}\% = 6\frac{1}{4}\left(\frac{1}{100}\right) = \frac{25}{4}\left(\frac{1}{100}\right) = \frac{1}{16}$

26. $3\frac{1}{3}\% = 3\frac{1}{3}\left(\frac{1}{100}\right) = \frac{10}{3}\left(\frac{1}{100}\right) = \frac{1}{30}$

27. $7.3\% = 7.3(0.01) = 0.073$

28. $9.1\% = 9.1(0.01) = 0.091$

29. $15.8\% = 15.8(0.01) = 0.158$

30. $16.7\% = 16.7(0.01) = 0.167$

31. $0.3\% = 0.3(0.01) = 0.003$

32. $0.9\% = 0.9(0.01)\ 0.009$

33. $121.2\% = 121.2(0.01) = 1.212$

34. $18.23\% = 18.23(0.01) = 0.1823$

35. $62.14\% = 62.14(0.01) = 0.6214$

36. $0.15\% = 0.15(0.01) = 0.0015$

37. $8.25\% = 8.25(0.01) = 0.0825$

38. $5.05\% = 5.05(0.01) = 0.0505$

39. $24\% = 24\left(\frac{1}{100}\right) = \frac{24}{100} = \frac{6}{25}$

$\frac{6}{25}$ of the owners would buy a house or car with their dog in mind.

Objective B Exercises, page 472

40. $0.15 = 0.15(100\%) = 15\%$

41. $0.37 = 0.37(100\%) = 37\%$

42. $0.05 = 0.05(100\%) = 5\%$

43. $0.02 = 0.02(100\%) = 2\%$

44. $0.175 = 0.175(100\%) = 17.5\%$

45. $0.125 = 0.125(100\%) = 12.5\%$

46. $1.15 = 1.15(100\%) = 115\%$

47. $1.36 = 1.36(100\%) = 136\%$

48. $0.62 = 0.62(100\%) = 62\%$

49. $0.96 = 0.96(100\%) = 96\%$

50. $2.09 = 2.09(100\%) = 209\%$

51. $0.07 = 0.07(100\%) = 7\%$

52. $\frac{27}{50} = \frac{27}{50}(100\%) = 54\%$

53. $\frac{83}{100} = \frac{83}{100}(100\%) = 83\%$

54. $\frac{37}{200} = \frac{37}{200}(100\%) = 18.5\%$

55. $\frac{1}{3} = \frac{1}{3}(100\%) \approx 33.3\%$

56. $\frac{5}{11} = \frac{5}{11}(100\%) \approx 45.5\%$

57. $\frac{4}{9} = \frac{4}{9}(100\%) \approx 44.4\%$

58. $\frac{7}{8} = \frac{7}{8}(100\%) = 87.5\%$

59. $\frac{9}{20} = \frac{9}{20}(100\%) = 45\%$

60. $1\frac{2}{3} = \frac{5}{3} = \frac{5}{3}(100\%) \approx 166.7\%$

61. $2\frac{1}{2} = \frac{5}{2} = \frac{5}{2}(100\%) = 250\%$

62. $\frac{2}{5} = \frac{2}{5}(100\%) = 40\%$

63. $\frac{1}{6} = \frac{1}{6}(100\%) \approx 16.7\%$

64. $\frac{17}{50} = \frac{17}{50}(100\%) = 34\%$

65. $\frac{17}{25} = \frac{17}{25}(100\%) = 68\%$

66. $\frac{3}{8} = \frac{3}{8}(100\%) = 37\frac{1}{2}\%$

67. $\frac{9}{16} = \frac{9}{16}(100\%) = 56\frac{1}{4}\%$

68. $1\frac{1}{4} = \frac{5}{4} = \frac{5}{4}(100\%) = 125\%$

69. $2\frac{5}{8} = \frac{21}{8} = \frac{21}{8}(100\%) = 262\frac{1}{2}\%$

70. $1\frac{5}{9} = \frac{14}{9} = \frac{14}{9}(100\%) = 155\frac{5}{9}\%$

71. $2\frac{5}{6} = \frac{17}{6} = \frac{17}{6}(100\%) = 283\frac{1}{3}\%$

72. $\frac{12}{25} = \frac{12}{25}(100\%) = 48\%$

73. $\frac{7}{30} = \frac{7}{30}(100\%) = 23\frac{1}{3}\%$

74. $\frac{3}{7} = \frac{3}{7}(100\%) = 42\frac{6}{7}\%$

75. $\frac{2}{9} = \frac{2}{9}(100\%) = 22\frac{2}{9}\%$

Critical Thinking 8.1, page 472

76. a. False: $50(200\%) = 50(2.00) = 100$

b. False: $\frac{10}{200\%} = \frac{10}{2} = 5$

c. True

d. False: $200\% = 2$

Section 8.2

Objective A Exercises, page 479

1. Strategy To find the amount, solve the basic percent equation. Percent = 8% = 0.08, base = 100, amount = n

   Solution Percent · base = amount
   $0.08 \cdot 100 = n$
   $8 = n$
   8% of 100 is 8.

2. Strategy To find the amount, solve the basic percent equation. Percent = 16% = 0.16, base = 50, amount = n

   Solution Percent · base = amount
   $0.16 \cdot 50 = n$
   $8 = n$
   16% of 50 is 8.

3. Strategy To find the amount, solve the basic percent equation. Percent = 0.05% = 0.0005, base = 150, amount = n.

   Solution Percent · base = amount
   $0.0005 \cdot 150 = n$
   $0.075 = n$
   0.05% of 150 is 0.075.

4. Strategy To find the amount, solve the basic percent equation. Percent = 0.075% = 0.00075, base = 625, amount = n

   Solution Percent · base = amount
   $0.00075 \cdot 625 = n$
   $0.46875 = n$
   0.075% if 625 is 0.46875.

5. Strategy To find the amount, solve the basic percent equation. Percent = n, base = 90, amount = 15

   Solution Percent · base = amount
   $\text{n} \cdot 90 = 15$
   $n = \frac{15}{90} = 0.16\frac{2}{3}$
   $n = 16\frac{2}{3}\%$
   15 is $16\frac{2}{3}\%$ of 90.

6. Strategy To find the percent, solve the basic percent equation. Percent = n, base = 60, amount = 24

   Solution Percent · base = amount
   $n \cdot 60 = 24$
   $n = \frac{24}{60} = 0.4$
   $n = 40\%$
   24 is 40% of 60.

7. Strategy To find the percent, solve the basic percent equation. Percent = n, base = 16, amount = 6

   Solution Percent · base = amount
   $n \cdot 16 = 6$
   $n = \frac{6}{16} = 0.375$
   $n = 37.5\%$

8. Strategy To find the percent, solve the basic percent equation. Percent = n, base = 24, amount = 18

   Solution Percent · base = amount
   $n \cdot 24 = 18$
   $n = \frac{18}{24} = 0.75$
   $n = 75\%$
   18 is 75% of 24.

9. Strategy To find the base, solve the basic percent equation. Percent = 10% = 0.10, base = n, amount = 10

   Solution Percent · base = amount
   $0.10 \cdot n = 10$
   $n = \frac{10}{0.10}$
   $n = 100$
   10 is 10% of 100.

10. Strategy To find the base, solve the basic percent equation. Percent = 37% = 0.37, base = n, amount = 37

    Solution Percent · base = amount
    $0.37 \cdot n = 37$
    $n = \frac{37}{0.37}$
    $n = 100$
    37 is 37% of 100.

11. Strategy To find the base, solve the basic percent equation. Percent = 2.5% = 0.025, base = n, amount = 30

Solution Percent · base = amount

$0.025 \cdot n = 30$

$n = \frac{30}{0.025}$

$n = 1{,}200$

2.5% of 1,200 is 30.

12. Strategy To find the base, solve the basic percent equation. Percent = 10.4% = 0.104, base = n, amount = 52

Solution Percent · base = amount

$0.104 \cdot n = 52$

$n = \frac{52}{0.104}$

$n = 500$

10.4% of 500 is 52.

13. Strategy To find the amount, solve the basic percent equation. Percent = 10.7% = 0.107, base = 485, amount = n

Solution Percent · base = amount

$0.107 \cdot 485 = n$

$51.895 = n$

10.7% of 485 is 51.895.

14. Strategy To find the amount, solve the basic percent equation. Percent = 12.8% = 0.128, base = 625, amount = n

Solution Percent · base = amount

$0.128 \cdot 625 = n$

$80 = n$

12.8% of 625 is 80.

15. Strategy To find the amount, solve the basic percent equation. Percent = 80% = 0.80, base = 16.25, amount = n

Solution Percent · base = amount

$0.80 \cdot 16.25 = n$

$13 = n$

80% of 16.25 is 13.

16. Strategy To find the amount, solve the basic percent equation. Percent = 26% = 0.26, base = 19.5, amount = n

Solution Percent · base = amount

$0.26 \cdot 19.5 = n$

$5.07 = n$

26% of 19.25 is 5.07.

17. Strategy To find the percent, solve the basic percent equation. Percent = n, base = 2,000, amount = 54

Solution Percent · base = amount

$n \cdot 2{,}000 = 54$

$n = \frac{54}{2{,}000} = 0.027$

$n = 2.7\%$

54 is 2.7% of 2,000.

18. Strategy To find the percent, solve the basic percent equation. Percent = n, base = 2,500, amount = 8

Solution Percent · base = amount

$n \cdot 2{,}500 = 8$

$n = \frac{8}{2{,}500} = 0.0032$

$n = 0.32\%$

8 is 0.32% of 2,500.

19. Strategy To find the percent, solve the basic percent equation. Percent = n, base = 4.1, amount = 16.4

Solution Percent · base = amount

$n \cdot 4.1 = 16.4$

$n = \frac{16.4}{4.1} = 4$

$n = 400\%$

16.4 is 400% of 4.1.

20. Strategy To find the percent, solve the basic percent equation. Percent = n, base = 50, amount = 5.3

Solution Percent · base = amount

$n \cdot 50 = 5.3$

$n = \frac{5.3}{50} = 0.106$

$n = 10.6\%$

5.3 is 10.6% of 50.

21. Strategy To find the percent, solve the basic percent equation.
Percent = 240% = 2.40, base = n, amount = 18

Solution Percent · base = amount
$2.40 \cdot n = 18$
$n = \frac{18}{2.40}$
$n = 7.5$
18 is 240% of 7.5.

22. Strategy To find the percent, solve the basic percent equation.
Percent = 320% = 3.20, base = n, amount = 24

Solution Percent · base = amount
$3.20 \cdot n = 24$
$n = \frac{24}{3.20}$
$n = 7.5$
24 is 320% of 7.5.

Objective B Exercises, pages 479–480

23. Percent = 26, base = 250, amount = n
$\frac{\text{percent}}{100} = \frac{\text{amount}}{\text{base}}$
$\frac{26}{100} = \frac{n}{250}$
$26 \cdot 250 = 100 \cdot n$
$6{,}500 = 100n$
$65 = n$
26% of 250 is 65.

24. Percent = 18, base = 150, amount = n
$\frac{\text{percent}}{100} = \frac{\text{amount}}{\text{base}}$
$\frac{18}{100} = \frac{n}{150}$
$18 \cdot 150 = 100 \cdot n$
$2{,}700 = 100n$
$27 = n$
18% of 150 is 27.

25. Percent = n, base = 148, amount = 37
$\frac{\text{percent}}{100} = \frac{\text{amount}}{\text{base}}$
$\frac{n}{100} = \frac{37}{148}$
$n \cdot 148 = 100 \cdot 37$
$148n = 3{,}700$
$n = \frac{3{,}700}{148}$
$n = 25$
37 is 25% of 148.

26. Percent = n, base = 150, amount = 33
$\frac{\text{percent}}{100} = \frac{\text{amount}}{\text{base}}$
$\frac{n}{100} = \frac{33}{150}$
$n \cdot 150 = 3{,}300$
$150n = 3{,}300$
$n = \frac{3{,}300}{150}$
$n = 22$
33 is 22% of 150.

27. Percent = 68, base = n, amount = 51
$\frac{\text{percent}}{100} = \frac{\text{amount}}{\text{base}}$
$\frac{68}{100} = \frac{51}{n}$
$68 \cdot n = 100 \cdot 51$
$68n = 5{,}100$
$n = \frac{5{,}100}{68}$
$n = 75$
68% of 75 is 51.

28. Percent = 84, base = n, amount = 126
$\frac{\text{percent}}{100} = \frac{\text{amount}}{\text{base}}$
$\frac{84}{100} = \frac{126}{n}$
$84 \cdot n = 100 \cdot 126$
$84n = 12{,}600$
$n = \frac{12{,}600}{84}$
$n = 150$
126 is 84% of 150.

29. Percent = n, base = 344, amount = 43
$\frac{\text{percent}}{100} = \frac{\text{amount}}{\text{base}}$
$\frac{n}{100} = \frac{43}{344}$
$n \cdot 344 = 100 \cdot 43$
$344n = 4{,}300$
$n = \frac{4{,}300}{344}$
$n = 12.5$
43 is 12.5% of 344.

30. Percent = n, base = 50, amount = 750

$\frac{\text{percent}}{100} = \frac{\text{amount}}{\text{base}}$

$\frac{n}{100} = \frac{750}{50}$

$n \cdot 50 = 100 \cdot 750$

$50n = 75{,}000$

$n = \frac{75{,}000}{50}$

$n = 1{,}500$

750 is 1,500% of 50.

31. Percent = 20.5, base = n, amount = 82

$\frac{\text{percent}}{100} = \frac{\text{amount}}{\text{base}}$

$\frac{20.5}{100} = \frac{82}{n}$

$20.5 \cdot n = 100 \cdot 82$

$20.5n = 8{,}200$

$n = \frac{8{,}200}{20.5}$

$n = 400$

82 is 20.5% of 400.

32. Percent = 2.4, base = n, amount = 21

$\frac{\text{percent}}{100} = \frac{\text{amount}}{\text{base}}$

$\frac{2.4}{100} = \frac{21}{n}$

$2.4 \cdot n = 100 \cdot 21$

$2.4n = 2{,}100$

$n = \frac{2{,}100}{2.4}$

$n = 875$

21 is 2.4% of 875.

33. Percent = 6.5, base = 300, amount = n

$\frac{\text{percent}}{100} = \frac{\text{amount}}{\text{base}}$

$\frac{6.5}{100} = \frac{n}{300}$

$6.5 \cdot 300 = 100 \cdot n$

$1{,}950 = 100n$

$19.5 = n$

19.5 is 6.5% of 300.

34. Percent = 96, base = 75, amount = n

$\frac{\text{percent}}{100} = \frac{\text{amount}}{\text{base}}$

$\frac{96}{100} = \frac{n}{75}$

$96 \cdot 75 = 100 \cdot n$

$7{,}200 = 100n$

$72 = n$

72 is 96% of 75.

35. Percent = n, base = 50, amount = 7.4

$\frac{\text{percent}}{100} = \frac{\text{amount}}{\text{base}}$

$\frac{n}{100} = \frac{7.4}{50}$

$n \cdot 50 = 100 \cdot 7.4$

$50n = 740$

$n = \frac{740}{50} = 14.8$

7.4 is 14.8% of 50.

36. Percent = n, base = 1,500, amount = 693

$\frac{\text{percent}}{100} = \frac{\text{amount}}{\text{base}}$

$\frac{n}{100} = \frac{693}{1{,}500}$

$n \cdot 1{,}500 = 100 \cdot 693$

$1{,}500n = 69{,}300$

$n = \frac{69{,}300}{1{,}500} = 46.2$

693 is 46.2% of 1,500.

37. Percent = 50.5, base = 124, amount = n

$\frac{\text{percent}}{100} = \frac{\text{amount}}{\text{base}}$

$\frac{50.5}{100} = \frac{n}{124}$

$50.5 \cdot 124 = 100 \cdot n$

$6{,}262 = 100n$

$62.62 = n$

62.62 is 50.5% of 124.

38. Percent = 87.4, base = 225, amount = n

$\frac{\text{percent}}{100} = \frac{\text{amount}}{\text{base}}$

$\frac{87.4}{100} = \frac{n}{225}$

$87.4 \cdot 225 = 100 \cdot n$

$19{,}665 = 100n$

$196.65 = n$

196.65 is 87.4% of 225.

39. Percent = 120, base = n, amount = 6

$\frac{\text{percent}}{100} = \frac{\text{amount}}{\text{base}}$

$\frac{120}{100} = \frac{6}{n}$

$120 \cdot n = 100 \cdot 6$

$120n = 600$

$n = \frac{600}{120}$

$n = 5$

120% of 5 is 6.

40. Percent = 175, base = n, amount = 14

$$\frac{\text{percent}}{100} = \frac{\text{amount}}{\text{base}}$$
$$\frac{175}{100} = \frac{14}{n}$$
$$175 \cdot n = 100 \cdot 14$$
$$175n = 1{,}400$$
$$n = \frac{1{,}400}{175}$$
$$n = 8$$

175% of 8 is 14.

41. Percent = 250, base = 18, amount = n

$$\frac{\text{percent}}{100} = \frac{\text{amount}}{\text{base}}$$
$$\frac{250}{100} = \frac{n}{18}$$
$$250 \cdot 18 = 100 \cdot n$$
$$4{,}500 = 100n$$
$$45 = n$$

250% of 18 is 45.

42. Percent = 325, base = 4.4, amount = n

$$\frac{\text{percent}}{100} = \frac{\text{amount}}{\text{base}}$$
$$\frac{325}{100} = \frac{n}{4.4}$$
$$325 \cdot 4.4 = 100 \cdot n$$
$$1{,}430 = 100n$$
$$14.3 = n$$

325% of 4.4 is 14.3.

43. Percent = n, base = 29, amount = 87

$$\frac{\text{percent}}{100} = \frac{\text{amount}}{\text{base}}$$
$$\frac{n}{100} = \frac{87}{29}$$
$$n \cdot 29 = 100 \cdot 87$$
$$29n = 8{,}700$$
$$n = \frac{8{,}700}{29}$$
$$n = 300$$

87 is 300% of 29.

44. Percent = n, base = 38, amount = 95

$$\frac{\text{percent}}{100} = \frac{\text{amount}}{\text{base}}$$
$$\frac{n}{100} = \frac{95}{38}$$
$$n \cdot 38 = 100 \cdot 95$$
$$38n = 9{,}500$$
$$n = \frac{9{,}500}{38}$$
$$n = 250$$

95 is 250% of 38.

Objective C Exercises, pages 480–482

45. Strategy: To find the life of the brakes, use the basic percent equation. Percent = 12% = 0.12, base = n, amount = 6,000

Solution:

$$\text{Percent} \cdot \text{base} = \text{amount}$$
$$0.12 \cdot n = 6{,}000$$
$$n = \frac{6{,}000}{0.12}$$
$$n = 50{,}000$$

The estimated life of the brakes is 50,000 mi.

46. Strategy: To find the amount collected, use the basic percent equation. Percent = 12% = 0.12, base = n, amount = 2,940

Solution:

$$\text{Percent} \cdot \text{base} = \text{amount}$$
$$0.12 \cdot n = 2{,}940$$
$$n = \frac{2{,}940}{0.12}$$
$$n = 24{,}500$$

The charity organization collected $24,500.

47. Strategy: To find the amount deducted, use the basic percent equation. Percent = 18% = 0.18, base = 2,240, amount = n

Solution:

$$\text{Percent} \cdot \text{base} = \text{amount}$$
$$0.18 \cdot 2{,}240 = n$$
$$403.20 = n$$

$403.20 was deducted for income taxes.

48. Strategy: To find the percent, use the basic percent equation. Percent = n, base = 94.4, amount = 91.4

Solution:

$$\text{Percent} \cdot \text{base} = \text{amount}$$
$$n \cdot 94.4 = 91.4$$
$$n = \frac{91.4}{94.4}$$
$$n \approx 0.968 = 96.8\%$$

The perihelion is 96.8% of the aphelion.

49. Strategy To find the percent of false alarms, use the basic percent equation.
Percent = n, base = 200, amount = 24

Solution Percent · base = amount
$n \cdot 200 = 24$
$n = \frac{24}{200}$
$n = 0.12 = 12\%$
The fire department received 12% false alarms.

50. Strategy To find the percent, use the basic percent equation.
Percent = n, base = 1,200,000, amount = 900,000

Solution Percent · base = amount
$n \cdot 1{,}200{,}000 = 900{,}000$
$n = \frac{900{,}000}{1{,}200{,}000}$
$n = 0.75 = 75\%$
The increase is 75% of the 2000 population.

51. Strategy To find the percent, use the basic percent equation.
Percent = n, base = 651,700, amount = 948,300

Solution Percent · base = amount
$n \cdot 651{,}700 = 948{,}300$
$n = \frac{948{,}300}{651{,}700}$
$n \approx 1.455 = 145.5\%$
The increase is 145.5% of the 2000 population.

52. Strategy To find the profit, use the basic percent equation.
Percent $= 16\frac{2}{3}\% = \frac{1}{6}$,
base = 24,000, amount = n

Solution Percent · base = amount
$\frac{1}{6} \cdot 24{,}000 = n$
$4{,}000 = n$
The expected profit is $4,000.

53. Strategy To find the number of pounds of turkey, use the basic percent equation.
Percent = 18.6% = 0.186, base = n, amount = 1,300,000

Solution Percent · base = amount
$0.186n = 1{,}300{,}000$
$n = \frac{1{,}300{,}000}{0.186}$
$n \approx 7{,}000{,}000$
The U.S. total turkey production was 7 million pounds.

54. Strategy To find the cost, use the basic percent equation.
Percent = 64% = 0.64, base = n, amount = 18,000

Solution Percent · base = amount
$0.64 \cdot n = 18{,}000$
$n = \frac{18{,}000}{0.64}$
$n = 28{,}125$
The cost of a new mobile home is $28,125.

55. Strategy To find the tax credit, use the basic percent equation.
Percent = 15% = 0.15, base = 85,000, amount = n

Solution Percent · base = amount
$0.15 \cdot 85{,}000 = n$
$12{,}750 = n$
The farmer received $12,750 in tax credits.

56. Strategy To find the down payment as a percent of the selling price, use the basic percent equation.
Percent = n, base = 8,900, amount = 1,780

Solution Percent · base = amount
$n \cdot 8{,}900 = 1{,}780$
$n = \frac{1{,}780}{8{,}900}$
$n = 0.2 = 20\%$
The down payment is 20% of the selling price.

57. Strategy To find the number of grams, use the basic percent equation.
Percent = 0.05% = 0.0005, base = 30, amount = n

Solution Percent · base = amount
$0.0005(30) = n$
$0.015 = n$
There are 0.015 g of the ingredient in a 30-gram tube.

58. Strategy To find the number, use the basic percent equation.
Percent = 7% = 0.07, base = 335,000,000,000, amount = n

Solution Percent · base = amount
$0.07(335{,}000{,}000{,}000) = n$
$23{,}450{,}000{,}000 = n$
The amount that came from the federal government is $23,450,000,000.

59. Strategy To find the percent, use the basic percent equation.
Percent = n, base = 8,000, amount = 870,000

Solution Percent · base = amount
$n \cdot 8{,}000 = 870{,}000$
$n = \dfrac{870{,}000}{8{,}000}$
$n = 108.75 = 10{,}875\%$
The sun's diameter is 10,875% of Earth's diameter.

60. Strategy To find the percent, use the basic percent equation.
Add all the costs to find the base.
Percent = n, base = (total), amount = 4,020

Solution $1{,}400 + 1{,}070 + 1{,}220 + 2{,}960 + 3{,}930 + 4{,}020 = 14{,}600$
Percent · base = amount
$n \cdot 14{,}600 = 4{,}020$
$n = \dfrac{4{,}020}{14{,}600}$
$n \approx 0.275 = 27.5\%$
Of the total cost, 27.5% is spent on food.

61. Strategy →To find the number of boards tested, use the basic percent equation.
Percent = 0.7% = 0.007, base = n, amount = 56
→To find the boards not defective, subtract 56 from the total number of boards tested.

Solution Percent · base = amount
$0.007 \cdot n = 56$
$n = \dfrac{56}{0.007} = 8{,}000$
$8{,}000 - 56 = 7{,}944$
8,000 computer boards were tested.
7,944 of the boards were not defective.

62. Strategy To find the percent, use the basic percent equation.
Percent = n, base = 5, amount = 1.1

Solution Percent · base = amount
$n \cdot 5 = 1.1$
$n = \frac{1.1}{5}$
$n \approx 0.22 = 22\%$
Direct loss to ranchers was 22% of the total losses.

63. Strategy To determine which percent of homicides in which guns were used was lower:
→Find the 1992 percent. Use the basic percent equation.
Percent = n, base = the total number of homicides (22,716), amount = the number of firearm homicides (15,489).
→Find the 1994 percent. Use the basic percent equation.
Percent = n, base = the total number of homicides (22,084), amount = the number of firearm homicides (15,463).
→Compare the two percents.

Solution Percent · base = amount
$n \cdot 22{,}716 = 15{,}489$
$n \approx 0.682 = 68.2\%$ (1992 percent)
Percent · base = amount
$n \cdot 22{,}084 = 15{,}463$
$n \approx 0.700 = 70.0\%$ (1994 percent)
$68.2\% < 70.0\%$
In 1992 the percent of homicides using guns was lower.

64. Strategy To determine which percent of homicides in which guns were used was higher:
→Find the 1996 percent. Use the basic percent equation.
Percent = n, base = the total number of homicides (16,976), amount = the number of firearm homicides (11,453).
→Find the 1998 percent. Use the basic percent equation.
Percent = n, base = the total number of homicides (14,088), amount = the number of firearm homicides (9,143).
→Compare the two percents.

Solution Percent · base = amount
$n \cdot 16{,}976 = 11{,}453$
$n \approx 0.675 = 67.5\%$ (1996 percent)
Percent · base = amount
$n \cdot 14{,}088 = 9.143$
$n \approx 0.649 = 64.9\%$ (1998 percent)
$67.5\% > 64.9\%$
In 1996 the percent of homicides using guns was higher.

Critical Thinking 8.2, page 482

65. Answers will vary.

Find 10% of 100. $0.10 \cdot 100 = 10$

$100 - 10 = 90$

Now find 10% of the result $0.10 \cdot 90 = 9$

$90 - 9 = 81$

Find 20% of 100. $0.20 \cdot 100 = 20$

$100 - 20 = 80$

No, the results of taking two consecutive 10% discounts or one 20% discount is not the same. The 20% discount was on the total of 100. The second 10% discount applied only to 90, not 100, thus the difference in results.

66. Increase 100 by 10% $100 + 0.10(100) = 100 + 10 = 110$

Now decrease 110 by 10% $110 - 0.10(110) = 110 - 11 = 99$

No, the new number is not the original number. The 10% increase applied to the number 100, while the decrease in 10% applied to 110, thus the decrease was greater than the increase.

67. For example, consider an initial salary of $20,000 and raises of 5%, 6%, and 7%.
Raise after Year 1: 5%(20,000) = 0.05(20,000) = 1,000
Salary after Year 1: 20,000 + 1,000 = 21,000

Raise after Year 2: 6%(21,000) = 0.06(21,000) = 1,260
Salary after Year 2: 21,000 + 1,260 = 22,260

Raise after Year 3: 7%(22,260) = 0.07(22,260) = 1,558.20
Salary after Year 3: 22,260 + 1,558.20 = 23,818.20

For an initial salary of $20,000 and raises of 6% each year,
Raise after Year 1: 6%(20,000) = 0.06(20,000) = 1,200
Salary after Year 1: 20,000 + 1,200 = 21,200

Raise after Year 2: 6%(21,200) = 0.06(21,200) = 1,272
Salary after Year 2: 21,200 + 1,272 = 22,472

Raise after Year 3: 6%(22,472) = 0.06(22,472) = 1,348.32
Salary after Year 3: 22,472 + 1,348.32 = 23,820.32

$23{,}818.20 < 23{,}820.32$

The raises of 5%, 6%, and 7% result in a lower salary than raises of 6% each year.

Section 8.3

Objective A Exercises, page 485

1. Strategy
To find percent increase:
→Find the increase in the number of stores.
→Use the basic percent equation. Percent = n, base = 420, amount = amount of increase

Solution
$914 - 420 = 494$
Percent · base = amount
$n \cdot 420 = 494$
$$n = \frac{494}{420}$$
$n \approx 1.176 = 117.6\%$
The percent increase in the number of stores is 117.6%.

2. Strategy
To find the percent increase:
→Find the increase in the number of events.
→Use the basic percent equation.
Percent = n, base = 14, amount = amount of increase

Solution
$78 - 14 = 64$
Percent · base = amount
$n \cdot 14 = 64$
$$n = \frac{64}{14}$$
$n \approx 4.571 = 457.1\%$
The percent increase in the number of events is 457.1%.

3. Strategy
To find the percent increase:
→Find the increase in the number of women
→Use the basic percent equation.
Percent = n, base = 3.8, amount = amount of increase

Solution
$5.2 - 3.8 = 1.4$
Percent · base = amount
$n \cdot 3.8 = 1.4$
$$n = \frac{1.4}{3.8}$$
$n \approx 0.368 = 36.8\%$
The percent increase is 36.8%.

4. Strategy
To find the percent increase:
→Find the increase in the number of books published.
→Use the basic percent equation. Percent = n, base = 2,437,000, amount = amount of increase

Solution
$2{,}500{,}000 - 2{,}437{,}000 = 63{,}000$
Percent · base = amount
$n \cdot 2{,}437{,}000 = 63{,}000$
$$n = \frac{63{,}000}{2{,}437{,}000}$$
$n \approx 0.026 = 2.6\%$
The percent increase in the number of books published is 2.6%.

5. Strategy
To find the percent increase:
→Find the increase in the number of millionaire households.
→Use the basic percent equation. Percent = n, base = 350,000, amount = amount of increase

Solution
$5{,}600{,}000 - 350{,}000 = 5{,}250{,}000$
Percent · base = amount
$n \cdot 350{,}000 = 5{,}250{,}000$
$$n = \frac{5{,}250{,}000}{350{,}000}$$
$n = 15 = 1{,}500\%$
The percent increase in the number of millionaire households is 1,500%.

6. Strategy
To find the percent increase:
→Find the increase in the amount of time.
→Use the basic percent equation. Percent = n, base = 4.4, amount = amount of increase

Solution
$7.6 - 4.4 = 3.2$
Percent · base = amount
$n \cdot 4.4 = 3.2$
$$n = \frac{3.2}{4.4}$$
$n \approx 0.727 = 72.7\%$
The percent increase is 72.7%.

7. Strategy

a. To find the 2-year period when the percent increase is the greatest, find the percent increase for all 2-year periods and compare.

b. To find the 2-year period when the percent increase is the lowest, find the percent increase for all 2-year periods and compare.

c. To determine the type of increase, compare each of the increases.

Solution

a. $10.4 - 9.6 = 0.8$
Percent · base = amount
$n \cdot 9.6 = 0.8$
$n = \frac{0.8}{9.6}$
$n \approx 0.083 = 8.3\%$ 1998–2000
$11 - 10.4 = 0.6$
Percent · base = amount
$n \cdot 10.4 = 0.6$
$n = \frac{0.6}{10.4}$
$n \approx 0.058 = 5.8\%$ 2000–2002
$11.2 - 11 = 0.2$
Percent · base = amount
$n \cdot 11 = 0.2$
$n = \frac{0.2}{11}$
$n \approx 0.0181 = 1.81\%$ 2002–2004
$11.4 - 11.2 = 0.2$
Percent · base = amount
$n \cdot 11.2 = 0.2$
$n = \frac{0.2}{11.2}$
$n \approx 0.0179 = 1.79\%$ 2004–2006
$8.3\% > 5.8\% > 1.81\% > 1.79\%$
The greatest percent increase was in 1998–2000.

b. $1.79\% < 1.81\% < 5.8\% < 8.3\%$
The lowest percent increase was in 2004–2006.

c. $8.3\% > 5.8\% > 1.81\% > 1.79\%$
The growth in telecommuting, increases more slowly.

Objective B Exercises, pages 485–486

8. Strategy To find the percent decrease in the food budget, use the basic percent equation.
Percent = n, base = 320, amount = 50

Solution Percent · base = amount
$n \cdot 320 = 50$
$n = \frac{50}{320}$
$n = 0.156 = 15.6\%$
The food budget is decreased by 15.6%.

9. Strategy To find the percent decrease, use the basic percent equation.
Percent = n, base = 394, amount = 26

Solution Percent · base = amount
$n \cdot 394 = 26$
$n = \frac{26}{394}$
$n \approx 0.066 = 6.6\%$
The percent decrease is 6.6%.

10. Strategy To find the percent decrease in time, use the basic percent equation.
Percent = n, base = 8, amount = the decrease in cleaning time

Solution $8 - 5 = 3$
Percent · base = amount
$n \cdot 8 = 3$
$n = \frac{3}{8}$
$n = 0.375 = 37.5\%$
The time for cleaning decreased by 37.5%.

11. Strategy To find the decrease in average time waiting:
→Find the decrease in time.
→Use the basic percent equation to find the percent decrease in time waiting.
Percent = n, base = 3.8
amount = decrease in time

Solution
$3.8 - 2.5 = 1.3$
Percent · base = amount
$n \cdot 3.8 = 1.3$
$n = \frac{1.3}{3.8}$
$n \approx 0.3421$
$n \approx 34.2\%$
The time waiting decreased approximately 34.2%.

12. Strategy To find the decrease in personnel:
→Find the decrease in personnel.
→Use the basic percent equation to find the percent decrease in personnel. Percent = n, base = 54,246, amount = decrease in personnel.

Solution
$54{,}246 - 36{,}940 = 17{,}306$
Percent · base = amount
$n \cdot 54{,}246 = 17{,}306$
$n = \frac{17{,}306}{54{,}246}$
$n \approx 0.319 = 31.9\%$
The number of personnel killed decreased approximately 31.9%.

13. Strategy To find the value after 1 year:
→Find the decrease in value by using the basic percent equation.
Percent = 30% = 0.30,
base = 21,900, amount = n
→Subtract the decrease in value from 21,900.

Solution
Percent · base = amount
$0.30 \cdot 21{,}900 = n$
$6{,}570 = n$
$21{,}900 - 6{,}570 = 15{,}330$
The value of the car after 1 year is $15,330.

14. Strategy To find the average bill:
→Find the decrease in expense by using the basic percent equation.
Percent = 22% = 0.22,
base = 92, amount = n
→Subtract the decrease in expenses from 92.

Solution
Percent · base = amount
$0.22 \cdot 92 = n$
$20.24 = n$
$92 - 20.24 = 71.76$
The average bill for gas is now $71.76.

15. Strategy To find the branch in which the percent decrease was the greatest, find the percent decrease for all military branches and compare:

Solution
$751 - 480 = 271$
Percent · base = amount
$n \cdot 751 = 271$
$n = \frac{271}{751}$
$n \approx 0.361 = 36.1\%$ Army
$583 - 372 = 211$
Percent · base = amount
$n \cdot 583 = 211$
$n = \frac{211}{583}$
$n \approx 0.362 = 36.2\%$ Navy
$539 - 361 = 178$
Percent · base = amount
$n \cdot 539 = 178$
$n = \frac{178}{539}$
$n \approx 0.330 = 33.0\%$ Air Force
$197 - 172 = 25$
Percent · base = amount
$n \cdot 197 = 25$
$n = \frac{25}{197}$
$n \approx 0.127 = 12.7\%$ Marines
$36.2\% > 36.1\% > 33.0\% > 12.7\%$
The Navy had the greatest decrease of personnel at 36.2%.

Critical Thinking 8.3, page 486

16. The order in which the coupons are applied to the purchase will not affect the purchase price. By multiplying the percents times the purchase price, and by the Commutative and Associative Properties of Multiplication, we can multiply factors in any order and the product will be the same.

17. A 30% discount reduces the price by $900

$3{,}000 \cdot 0.30 = 900$
$3{,}000 - 900 = 2{,}100$

A further discount of 10% reduces the price by $210. The total discount is $1,110.

$2{,}100 \cdot 0.10 = 210$
$2{,}100 - 210 = 1{,}890$

The sale price after the two discounts is $1,890.

A single discount of 40% reduces the price to $1,800.

$3{,}000 \cdot 0.40 = 1{,}200$
$3{,}000 - 1{,}200 = 1{,}800$

By comparing the sale prices, the 40% discount is $90 greater than the successive discounts of 30% and 10%.

The equivalent discount of the successive discounts is 37%.

$\frac{1{,}110}{3{,}000} = 0.37$

Section 8.4

Objective A Exercises, page 491

1. Strategy To find the markup, solve the formula $M = r \cdot C$ for M.
$r = 55\%,\ C = 110$

Solution
$M = r \cdot C$
$M = 0.55 \cdot 110$
$M = 60.50$
The markup on the cost is $60.50.

2. Strategy To find the markup, solve the formula $M = r \cdot C$ for M.
$r = 30\%,\ C = 315$

Solution
$M = r \cdot C$
$M = 0.30 \cdot 315$
$M = 94.50$
The markup on the cost is $94.50.

3. Strategy To find the markup rate:
→Solve the formula $M = S - C$ for M.
$S = 156.80,\ C = 98$
→Solve the formula $M = r \cdot C$ for r.

Solution
$M = S - C$
$M = 156.80 - 98$
$M = 58.80$
$M = r \cdot C$
$58.80 = r \cdot 98$
$\frac{58.80}{98} = r$
$0.60 = r$
The markup rate on the cost is 60%.

4. Strategy To find the markup rate:
→Solve the formula $M = S - C$ for M.
$S = 630,\ C = 360$
→Solve the formula $M = r \cdot C$ for r.

Solution
$M = S - C$
$M = 630 - 360$
$M = 270$
$M = r \cdot C$
$270 = r \cdot 360$
$\frac{270}{360} = r$
$0.75 = r$
The markup rate on the cost is 75%.

5. Strategy To find the markup rate:
→Solve the formula $M = S - C$ for M.
$S = 520$, $C = 360$
→Solve the formula $M = r \cdot C$ for r.

Solution
$M = S - C$
$M = 520 - 360$
$M = 160$
$M = r \cdot C$
$160 = r \cdot 360$
$\frac{160}{360} = r$
$0.4444 \approx r$
The markup rate on the cost is approximately 44.4%.

6. Strategy To find the markup rate:
→Solve the formula $M = S - C$ for M.
$S = 479$, $C = 320$
→Solve the formula $M = r \cdot C$ for r.

Solution
$M = S - C$
$M = 479 - 320$
$M = 159$
$M = r \cdot C$
$159 = r \cdot 320$
$\frac{159}{320} = r$
$0.4969 \approx r$
The markup rate on the cost is approximately 49.7%.

7. Strategy To find the selling price, solve the formula $S = (1 + r)C$ for S.
$r = 25\%$, $C = 1{,}750$

Solution
$S = (1 + r)C$
$S = (1 + 0.25) \cdot 1{,}750$
$s = 1.25 \cdot 1{,}750$
$S = 2{,}187.50$
The selling price of the computer is $2,187.50.

8. Strategy To find the selling price, solve the formula $S = (1 + r)$ for S.
$r = 125\%$, $C = 7.60$

Solution
$S = (1 + r)C$
$S = (1 + 1.25) \cdot 7.60$
$S = 2.25 \cdot 7.60$
$S = 17.10$
The selling price of the strawberries is $17.10.

9. Strategy To find the selling price, solve the formula $S = (1 + r)$ for S.
$r = 75\%$, $C = 47$

Solution
$S = (1 + r)C$
$S = (1 + 0.75) \cdot 47$
$S = 1.75 \cdot 47$
$S = 82.25$
The selling price of the sneakers is $82.25.

10. Strategy To find the selling price, solve the formula $S = (1 + r)$ for S.
$r = 58\%$, $C = 225$

Solution
$S = (1 + r)C$
$S = (1 + 0.58) \cdot 225$
$S = 1.58 \cdot 225$
$S = 355.50$
The selling price of the leather jacket is $355.50.

Objective B Exercises, pages 491–492

11. Strategy To find the markdown, solve the formula $M = R - S$ for M.
$R = 460$, $S = 350$

Solution
$M = R - S$
$M = 460 - 350$
$M = 110$
The markdown is $110.

12. Strategy To find the markdown, solve the formula $M = R - S$ for M.
$R = 179$, $S = 119$

Solution
$M = R - S$
$M = 179 - 119$
$M = 60$
The markdown is $60.

13. Strategy To find the markdown rate:
$\rightarrow$Solve the formula
$M = R - S$ for M.
$R = 1{,}295$, $S = 995$
$\rightarrow$Solve the formula
$M = r \cdot R$ for r.

Solution
$M = R - S$
$M = 1{,}295 - 995$
$M = 300$
$M = r \cdot R$
$300 = r \cdot 1{,}295$
$\frac{300}{1{,}295} = r$
$0.2317 \approx r$
The discount rate is approximately 23.2%.

14. Strategy To find the markdown rate:
$\rightarrow$Solve the formula
$M = R - S$ for M.
$R = 495$, $S = 380$
$\rightarrow$Solve the formula
$M = r \cdot R$ for r.

Solution
$M = R - S$
$M = 495 - 380$
$M = 115$
$M = r \cdot R$
$115 = r \cdot 495$
$\frac{115}{495} = r$
$0.2323 \approx r$
The discount rate is approximately 23.2%.

15. Strategy To find the discount rate:
$\rightarrow$Solve the formula
$M = R - S$ for M.
$R = 325$, $S = 201.50$
$\rightarrow$Solve the formula
$M = r \cdot R$ for r.

Solution
$M = R - S$
$M = 325 - 201.50$
$M = 123.50$
$M = r \cdot R$
$123.50 = r \cdot 325$
$\frac{123.50}{325} = r$
$0.38 = r$
The discount rate is 38%.

16. Strategy To find the discount rate:
$\rightarrow$Solve the formula
$M = R - S$ for M.
$R = 178$, $S = 103.24$
$\rightarrow$Solve the formula
$M = r \cdot R$ for r.

Solution
$M = R - S$
$M = 178 - 103.24$
$M = 74.76$
$M = r \cdot R$
$74.76 = r \cdot 178$
$\frac{74.76}{178} = r$
$0.42 = r$
The discount rate is 42%.

17. Strategy To find the sale price, solve the formula
$S = (1 - r)R$ for S.
$r = 30\%$, $R = 1{,}995$

Solution
$S = (1 - r)R$
$S = (1 - 0.30) \cdot 1{,}995$
$S = 0.70 \cdot 1{,}995$
$S = 1{,}396.50$
The sale price is \$1,396.50

18. Strategy To find the sale price, solve the formula
$S = (1 - r)R$ for S.
$r = 45\%$, $R = 1{,}600$

Solution
$S = (1 - r)R$
$S = (1 - 0.45) \cdot 1{,}600$
$S = 0.55 \cdot 1{,}600$
$S = 880$
The sale price is \$880.

19. Strategy To find the sale price, solve the formula
$S = (1 - r)R$ for S.
$r = 40\%$, $R = 42$

Solution
$S = (1 - r)R$
$S = (1 - 0.40) \cdot 42$
$S = 0.60 \cdot 42$
$S = 25.20$
The sale price is \$25.20.

20. Strategy To find the sale price, solve the formula
$S = (1 - r)R$ for S.
$r = 55\%$, $R = 415$

Solution
$S = (1 - r)R$
$S = (1 - 0.55) \cdot 415$
$S = 0.45 \cdot 415$
$S = 186.75$
The sale price is \$186.75.

21. Strategy To find the regular price, solve the formula
$S(1 - r)R$ for R.
$r = 40\%$, $S = 180$

Solution
$S = (1 - r)R$
$180 = (1 - 0.40) \cdot R$
$180 = 0.60R$
$\frac{180}{0.60} = R$
$300 = R$
The regular price is \$300.

22. Strategy To find the regular price, solve the formula
$S(1 - r)R$ for R.
$r = 22\%$, $S = 65$

Solution
$S = (1 - r)R$
$65 = (1 - 0.22) \cdot R$
$65 = 0.78R$
$\frac{65}{0.78} = R$
$83.33 \approx R$
The regular price is approximately \$83.33.

23. Strategy To find the regular price, solve the formula
$S(1 - r)R$ for R.
$r = 35\%$, $S = 80$

Solution
$S = (1 - r)R$
$80 = (1 - 0.35) \cdot R$
$80 = 0.65R$
$\frac{80}{0.65} = R$
$123.08 \approx R$
The regular price is approximately \$123.08.

Critical Thinking 8.4, page 492

24. Strategy To find the percent discount, use the basic percent equation.
Percent = n, base = 3.89, amount = 2(25¢) = 50¢ = 0.50

Solution
Percent · base = amount
$n \cdot 3.89 = 0.50$
$n = \frac{0.50}{3.89}$
$n \approx 0.129 = 12.9\%$
The percent discount is 12.9%.

25. The sale price after a 20% discount is \$4,400.
$S = (1 - 0.20)5{,}500$
$= 4{,}400$

Another 10% discount would give a sale price of \$3,960.
$S = (1 - 0.10)4{,}400$
$= 3{,}960$

A single discount of 30% would give a sale price of \$3,850.
$S = (1 - 0.30)5{,}500$
$= 3{,}850$

Thus a 30% discount is not equivalent to the successive discounts of 20% and 10%.

The total amount of the successive discounts is 5,500 – 3,960 = 1,540. The single discount equivalent is 28%.
$\frac{1{,}540}{5{,}500} = 0.28$

Section 8.5

Objective A Exercises, pages 495–496

3. a. $I = Prt$

1 month: $I = 5{,}000 \cdot 0.06 \cdot \frac{1}{12} = \$25$

2 month: $I = 5{,}000 \cdot 0.06 \cdot \frac{2}{12} = \$50$

3 month: $I = 5{,}000 \cdot 0.06 \cdot \frac{3}{12} = \$75$

4 month: $I = 5{,}000 \cdot 0.06 \cdot \frac{4}{12} = \$100$

5 month: $I = 5{,}000 \cdot 0.06 \cdot \frac{5}{12} = \$125$

b. \$150

c. \$175

d. \$200

e. \$225

4. a. To calculate the interest for a 7-month loan, multiply the interest due on a one month loan by 7.

b. If the time period is doubled, then the simple interest due is doubled, or 2 times larger.

5. Strategy To find the simple interest, solve the simple interest formula $I = Prt$ for I.

$P = 15{,}000$, $t = \frac{90}{365}$, $r = 0.074$

Solution $I = Prt$

$I = 15{,}000(0.074)\left(\frac{90}{365}\right)$

$I = 273.65$

The interest on the loan is \$273.65.

6. Strategy To find the simple interest, solve the simple interest formula $I = Prt$ for I.

$P = 7{,}500$, $t = \frac{75}{365}$, $r = 0.095$

Solution $I = Prt$

$I = (7{,}500)(0.095)\left(\frac{75}{365}\right)$

$I = 146.40$

The interest on the loan is \$146.40.

7. Strategy To find the simple interest, solve the simple interest formula $I = Prt$ for I.

$P = 100{,}000$, $t = \frac{9}{12}$, $r = 0.09$

Solution $I = Prt$

$I = (100{,}000)(0.09)\left(\frac{9}{12}\right)$

$I = 6{,}750$

The interest on the loan is \$6,750.

8. Strategy To find the simple interest, solve the simple interest formula $I = Prt$ for I.

$P = 50{,}000$, $t = \frac{8}{12}$, $r = 0.095$

Solution $I = Prt$

$I = (50{,}000)(0.095)\left(\frac{8}{12}\right)$

$I = 3{,}166.67$

The interest on the loan is \$3,166.67.

9. Strategy To find the simple interest, solve the simple interest formula $I = Prt$ for I.
$P = 1{,}250$,
$rt = 0.016$ (rate per month)

Solution $I = Prt$
$I = (1{,}250)(0.016)$
$I = 20$
The interest owed to VISA is \$20.

10. Strategy To find the simple interest, solve the simple interest formula $I = Prt$ for I.
$P = 800$,
$rt = 0.02$ (rate per month)

Solution $I = Prt$
$I = (800)(0.02)$
$I = 16$
The interest owed to the credit union is \$16.

11. Strategy To find the simple interest, solve the simple interest formula $I = Prt$ for I.
$P = 8{,}000$, $t = 2$,
$r = 0.09$

Solution $I = Prt$
$I = (8{,}000)(0.09)(2)$
$I = 1{,}440$
The interest on the 2-year loan is \$1,440.

12. Strategy To find the simple interest, solve the interest formula $I = Prt$ for I.
$P = 1{,}500$, $t = 1\frac{1}{2}$,
$r = 0.075$

Solution $I = Prt$
$I = (1{,}500)(0.075)\left(\frac{3}{2}\right)$
$I = 168.75$
The interest on the loan is \$168.75.

13. Strategy To find the maturity value:
→Solve the formula $I = Prt$ for I.
$P = 150{,}000$, $r = 0.095$, $t = 1$
→Use the formula for the maturity value of a simple interest loan, $M = P + I$.

Solution $I = Prt$
$I = 150{,}000(0.095)(1)$
$I = 14{,}250$
$M = P + I$
$M = 150{,}000 + 14{,}250$
$M = 164{,}250$
The maturity value is \$164,250.

14. Strategy To find the maturity value:
→Solve the formula $I = Prt$ for I.
$P = 25{,}000$, $r = 0.082$, $t = 1$
→Use the formula for the maturity value of a simple interest loan, $M = P + I$.

Solution $I = Prt$
$I = 25{,}000(0.082)(1)$
$I = 2{,}050$
$M = P + I$
$M = 25{,}000 + 2{,}050$
$M = 27{,}050$
The maturity value is \$27,050.

15. Strategy To find the maturity value:
→Solve the formula $I = Prt$ for I.
$P = 14{,}000$, $r = 0.1025$,
$t = \frac{270}{365}$.
→Use the formula for the maturity value of a simple interest loan, $M = P + I$.

Solution $I = Prt$
$I = (14{,}000)(0.1025)\left(\frac{270}{365}\right)$
$I = 1{,}061.51$
$M = P + I$
$M = 14{,}000 + 1{,}061.51$
$M = 15{,}061.51$
The maturity value is \$15,061.51.

16. Strategy To find the maturity value:
→Solve the formula $I = Prt$ for I.
$P = 5{,}000$, $r = 0.069$, $t = \frac{18}{12}$.
→Use the formula for the maturity value of a simple interest loan, $M = P + I$.

Solution $I = Prt$
$I = (5{,}000)(0.069)\left(\frac{18}{12}\right)$
$I = 517.50$
$M = P + I$
$M = 5{,}000 + 517.50$
$M = 5{,}517.50$
The maturity value is \$5,517.50

17. Strategy To find the interest rate, solve the formula $I = Prt$ for r.
$I = 462,\ P = 12{,}000,\ t = \frac{6}{12}$

Solution
$I = Prt$
$462 = (12{,}000)(r)\left(\frac{6}{12}\right)$
$462 = 6{,}000r$
$\frac{462}{6{,}000} = r$
$0.077 = r$
The simple interest rate is 7.7%.

18. Strategy To find the interest rate, solve the formula $I = Prt$ for r.
$I = 168.75,\ P = 3{,}000,\ t = \frac{9}{12}$

Solution
$I = Prt$
$168.75 = (3{,}000)(r)\left(\frac{9}{12}\right)$
$168.75 = 2{,}250r$
$\frac{168.75}{2{,}250} = r$
$0.075 = r$
The simple interest rate is 7.5%.

19. Strategy To find the rate, solve the formula $I = Prt$ for r.
$I = 937.50,\ P = 50{,}000,\ t = \frac{75}{365}$

Solution
$I = Prt$
$937.50 = 50{,}000(r)\left(\frac{75}{365}\right)$
$937.50 = \frac{750{,}000}{73}r$
$\frac{73 \cdot 937.50}{750{,}000} = r$
$0.09125 = r$
The interest rate is 9.125%.

20. Strategy To find the rate, solve the formula $I = Prt$ for r.
$I = 604.80,\ P = 18{,}000,\ t = \frac{210}{365}$

Solution
$I = Prt$
$604.80 = 18{,}000(r)\left(\frac{210}{365}\right)$
$604.80 = \frac{756{,}000}{73}r$
$\frac{73 \cdot 604.80}{756{,}000} = r$
$0.0584 = r$
The interest rate is 5.84%.

Chapter Review Exercises, pages 501–502

1. $32\% = 32\left(\frac{1}{100}\right) = \frac{32}{100} = \frac{8}{25}$
2. $22\% = 22(0.01) = 0.22$
3. $25\% = 25\left(\frac{1}{100}\right) = \frac{25}{100} = \frac{1}{4}$
   $25\% = 25(0.01) = 0.25$
4. $3\frac{2}{5}\% = 3\frac{2}{5}\left(\frac{1}{100}\right) = \frac{17}{5}\left(\frac{1}{100}\right) = \frac{17}{500}$
5. $\frac{7}{40} = \frac{7}{40}(100\%) = 17.5\%$
6. $1\frac{2}{7} = 1\frac{2}{7}(100\%) = \frac{9}{7}(100\%) = \frac{900}{7}\%$
   $\approx 128.6\%$
7. $2.8 = 2.8(100\%) = 280\%$
8. Strategy To find the amount, solve the basic percent equation.
   Percent = 42% = 0.42, base = 50, amount = n

   Solution
   Percent · base = amount
   $0.42 \cdot 50 = n$
   $21 = n$
   42% of 50 is 21.

9. Strategy To find the percent, solve the basic percent equation.
Percent = n, base = 3, amount = 15

Solution Percent · base = amount
$n \cdot 3 = 15$
$n = \frac{15}{3}$
$n = 5 = 500\%$
500% of 3 is 15.

10. Strategy To find the percent, solve the basic percent equation.
Percent = n, base = 18, amount = 12

Solution Percent · base = amount
$n \cdot 18 = 12$
$n = \frac{12}{18}$
$n \approx 0.667 = 66.7\%$
12 is approximately 66.7% of 18.

11. Strategy To find the amount, solve the basic percent equation.
Percent = 150% = 1.50, base = 20, amount = n

Solution Percent · base = amount
$1.50 \cdot 20 = n$
$30 = n$
150% of 20 is 30.

12. Strategy To find the amount, solve the basic percent equation.
Percent = 18% = 0.18, base = 85, amount = n

Solution Percent · base = amount
$0.18 \cdot 85 = n$
$15.3 = n$
18% of 85 is 15.3.

13. Strategy To find the base, solve the basic percent equation.
Percent = 32% = 0.32, base = n, amount = 180

Solution Percent · base = amount
$0.32 \cdot n = 180$
$n = \frac{180}{0.32}$
$n = 562.5$
32% of 562.5 is 180.

14. Strategy To find the percent, solve the basic percent equation.
Percent = n, base = 80, amount = 4.5

Solution Percent · base = amount
$n \cdot 80 = 4.5$
$n = \frac{4.5}{80}$
$n = 0.05625 = 5.625\%$
4.5 is 5.625% of 80.

15. Strategy To find the amount, solve the basic percent equation.
Percent = 0.58% = 0.0058, base = 2.54, amount = n

Solution Percent · base = amount
$0.0058 \cdot 2.54 = n$
$0.014732 = n$
0.58% of 2.54 is 0.014732.

16. Strategy To find the base, solve the basic percent equation.
Percent = 0.05% = 0.0005, base = n, amount = 0.0048

Solution Percent · base = amount
$0.0005 \cdot n = 0.0048$
$n = \frac{0.0048}{0.0005}$
$n = 9.6$
0.0048 is 0.05% of 9.6.

17. Strategy To find the percent visiting in China:
→Add to find the total amount of tourists visiting the four countries.
→Use the basic percent equation to find the percent.
Percent = n, base = the total amount of tourists visiting the four countries, amount = 137 million

Solution $137 + 93 + 71 + 102 = 403$
Percent · base = amount
$n \cdot 403 = 137$
$n = \frac{137}{403}$
$n \approx 0.340 = 34.0\%$
About 34.0% of the tourists will be visiting China.

18. Strategy: To find the amount of the budget spent for advertising, use the basic percent equation.
Percent = 7% = 0.07,
base = 120,000, amount = n

Solution: Percent · base = amount
$0.07 \cdot 120{,}000 = n$
$8{,}400 = n$
$8,400 of the budget was spent for advertising.

19. Strategy: To find the number of phones that were not defective:
→Find the number of defective phones by using the basic percent equation.
Percent = 1.2% = 0.012,
base = 4,000, amount = n
→Subtract the number of defective phones from 4,000.

Solution: Percent · base = amount
$0.012 \cdot 4{,}000 = n$
$48 = n$
$4{,}000 - 48 = 3{,}952$
3,952 of the telephones were not defective.

20. Strategy: To find the percent of the week, use the basic percent equation.
Percent = n, base = 168,
amount = 61.35.

Solution: Percent · base = amount
$n \cdot 168 = 61.35$
$n = \frac{61.35}{168}$
$n \approx 0.365 = 36.5\%$
The percent is approximately 36.5% of the week.

21. Strategy: To find the expected profit, use the basic percent equation.
Percent = 22% = 0.22,
base = 750,000, amount = n

Solution: Percent · base = amount
$0.22 \cdot 750{,}000 = n$
$165{,}000 = n$
The expected profit is $165.000.

22. Strategy: To find the number of seats added, use the basic percent equation.
Percent = 18% = 0.18,
base = 9,000, amount = n

Solution: Percent · base = amount
$0.18 \cdot 9{,}000 = n$
$1{,}620 = n$
1,620 seats were added to the auditorium.

23. Strategy: To find the number of tickets sold:
→Use the basic percent equation to find the number of seats overbooked.
Percent = 12% = 0.12,
base = 175, amount = n
→Add the number of seats overbooked to 175.

Solution: Percent · base = amount
$0.12 \cdot 175 = n$
$21 = n$
$21 + 175 = 196$
The airline would sell 196 tickets.

24. Strategy: To find the percent of registered voters that voted, use the basic percent equation.
Percent = n, based = 112,000,
amount = 25,400

Solution: Percent · base = amount
$n \cdot 112{,}000 = 25{,}400$
$n = \frac{25{,}400}{112{,}000}$
$n \approx 0.227 = 22.7\%$
Approximately 22.7% of the registered voters voted in the city election.

25. Strategy To find the typist's new hourly wage:
→Find the increase by using the basic percent equation.
Percent = 8% = 0.08, base = 10.50, amount = n
→Add the increase to 10.50.

Solution
Percent · base = amount
$0.08 \cdot 10.50 = n$
$0.84 = n$
$0.84 + 10.50 = 11.34$
The clerk typist's new wage is \$11.34 per hour.

26. Strategy To find the percent decrease in cost:
→Subtract to find the dollar decrease in the cost of the computer.
→Find the percent decrease by using the basic percent equation.
Percent = n, base = 2,400, amount = decrease in price

Solution
$2{,}400 - 1{,}800 = 600$
Percent · base = amount
$n \cdot 2{,}400 = 600$
$n = \frac{600}{2,400}$
$n = 0.25 = 25\%$
The computer decreased 25% in cost.

27. Strategy To find the selling price of the car:
→Use the basic percent equation to find the markup.
Percent = 6% = 0.06, base = 18,500, amount = n
→Add the markup to 18,500.

Solution
Percent · base = amount
$0.06 \cdot 18{,}500 = n$
$1{,}110 = n$
$1{,}110 + 18{,}500 = 19{,}610$
The selling price of the car is \$19,610.

28. Strategy To find the markup rate:
→Solve the formula $M = S - C$ for M.
$S = 181.50$, $C = 110$
→Solve the formula $M = r \cdot C$ for r.

Solution
$M = S - C$
$M = 181.50 - 110$
$M = 71.50$
$M = r \cdot C$
$71.50 = r \cdot 110$
$\frac{71.50}{110} = r$
$0.65 = r$
The markup rate of the parka is 65%.

29. Strategy To find the sale price, solve the formula $S = (1 - r)R$ for S.
$r = 0.30$, $R = 80$

Solution
$S = (1 - r)R$
$S = (1 - 0.30) \cdot 80$
$S = 0.70 \cdot 80$
$S = 56$
The sale price of the tennis racket is \$56.

30. Strategy To find the sale price, solve the formula $S = (1 - r)R$ for S.
$r = 0.40$, $R = 650$

Solution
$S = (1 - r)R$
$S = (1 - 0.40) \cdot 650$
$S = 0.60 \cdot 650$
$S = 390$
The sale price of the ticket is \$390.

31. Strategy To find the simple interest, solve the formula $I = Prt$ for I.
$P = 3{,}000$, $r = 0.086$, $t = \frac{45}{360}$

Solution
$I = Prt$
$I = 3{,}000(0.086)\left(\frac{45}{360}\right)$
$I = 32.25$
The interest on the loan is \$32.25.

32. Strategy To find the rate, solve the formula $I = Prt$ for r.
$I = 7{,}397.26$, $P = 500{,}000$,
$t = \frac{60}{365}$

Solution $I = Prt$

$$7{,}397.26 = 500{,}000(r)\left(\frac{60}{365}\right)$$
$$7{,}397.26 = \frac{6{,}000{,}000}{73}r$$
$$\frac{73 \cdot 7{,}397.26}{6{,}000{,}000} = r$$
$$0.09 = r$$

The interest rate is 9%.

33. Strategy To find the maturity value:
→Solve the formula $I = Prt$ for I.
$P = 10{,}000$, $r = 0.084$,
$t = \frac{9}{12}$.
→Use the formula for the maturity value of a simple interest loan, $M = P + I$.

Solution $I = Prt$

$$I = (10{,}000)(0.084)\left(\frac{9}{12}\right)$$
$$I = 640$$
$$M = P + I$$
$$M = 10{,}000 + 630$$
$$M = 10{,}630$$

The maturity value is \$10,630.

Chapter Test, pages 503–504

1. $86.4\% = 86.4(0.01) = 0.864$

2. $0.4 = 0.4(100\%) = 40\%$

3. $\frac{5}{4} = \frac{5}{4}(100\%) = 125\%$

4. $83\frac{1}{3}\% = 83\frac{1}{3}\left(\frac{1}{100}\right) = \frac{250}{3}\left(\frac{1}{100}\right) = \frac{5}{6}$

5. $32\% = 32\left(\frac{1}{100}\right) = \frac{32}{100} = \frac{8}{25}$

6. $1.18 = 1.18(100\%) = 118\%$

7. Strategy To find the base, solve the basic percent equation.
Percent = 20% = 0.20,
base = n, amount = 18

Solution Percent · base = amount
$0.20 \cdot n = 18$
$n = \frac{18}{0.20} = 90$
20% of 90 is 18.

8. Strategy To find the amount, solve the basic percent equation.
Percent = 68% = 0.68,
base = 73, amount = n

Solution Percent · base = amount
$0.68 \cdot 73 = n$
$49.64 = n$
68% of 73 is 49.64.

9. Strategy To find the percent, solve the basic percent equation.
Percent = n, base = 320,
amount = 180

Solution Percent · base = amount
$n \cdot 320 = 180$
$n = \frac{180}{320}$
$n = 0.5625 = 56.25\%$
56.25% of 320 is 180.

10. Strategy To find the base, solve the basic percent equation.
Percent = 14% = 0.14,
base = n, amount = 28

Solution Percent · base = amount
$0.14 \cdot n = 28$
$n = \frac{28}{0.14} = 200$
14% of 200 is 28.

11. Strategy To find the amount of expected accidents, use the basic percent equation.
Percent = 2.2% = 0.022,
base = 1,500, amount = n

Solution Percent · base = amount
$0.022 \cdot 1{,}500 = n$
$33 = n$
33 accidents are expected.

12. Strategy

To find the percent answered correctly, use the basic percent equation.
Percent = n, base = 90,
amount = 90 – 16 = 74.

Solution

Percent · base = amount
$n \cdot 90 = 74$
$n = \frac{74}{90}$
$n \approx 0.822 = 82.2\%$
The percent is approximately 82.2% correct.

13. Strategy

To find the dollar increase:
→Find the increase by using the basic percent equation.
Percent = 120% = 1.20,
base = n, amount = 480
→Subtract the increase from 480.

Solution

Percent · base = amount
$1.20 \cdot n = 480$
$n = \frac{480}{1.20}$
$n = 400$
$480 - 400 = 80$
The dollar increase is $80.

14. Strategy

To find the percent decrease in cost:
→Subtract to find the dollar increase in the cost for public tuition.
→Find the percent increase by using the basic percent equation.
Percent = n, base = 7,628,
amount = increase in price

Solution

$19{,}143 - 7{,}628 = 11{,}515$
Percent · base = amount
$n \cdot 7{,}628 = 11{,}515$
$n = \frac{11{,}515}{7{,}628}$
$n \approx 1.510 = 151.0\%$
The tuition increased 151.0%.

15. Strategy

To find the percent decrease in cost:
→Subtract to find the increase in trainees.
→Find the percent increase by using the basic percent equation.
Percent = n, base = 36,
amount = increase in trainees.

Solution

$42 - 36 = 6$
Percent · base = amount
$n \cdot 36 = 6$
$n = \frac{6}{36}$
$n \approx 0.1667 = 16.67\%$
The number of trainees increased by approximately 16.67%.

16. Strategy

a. To find the percent decrease in fat:
→Subtract to find the decrease in fat.
→Find the percent decrease by using the basic percent equation.
Percent = n, base = 24,
amount = decrease in fat.

b. To find the percent decrease in cholesterol:
→Subtract to find the decrease in cholesterol.
→Find the percent decrease by using the basic percent equation.
Percent = n, base = 75,
amount = decrease in cholesterol.

c. To find the percent decrease in calories:
→Subtract to find the decrease in calories.
→Find the percent decrease by using the basic percent equation.
Percent = n, base = 280,
amount = decrease in calories.

Solution

a. $24 - 4 = 20$
Percent · base = amount
$n \cdot 24 = 20$
$$n = \frac{20}{24}$$
$n \approx 0.8333 = 83.33\%$
The fat content decreased by 83.33%.

b. $75 - 0 = 75$
Percent · base = amount
$n \cdot 75 = 75$
$$n = \frac{75}{75}$$
$n = 1 = 100\%$
The cholesterol percent decreased by 100%.

c. $280 - 140 = 140$
Percent · base = amount
$n \cdot 280 = 140$
$$n = \frac{140}{280}$$
$n = 0.5 = 50\%$
The calorie percent decreased by 50%.

17. Strategy To find the decrease in personnel:
→Find the decrease in travel expenses.
→Use the basic percent equation to find the percent decrease in expenses. Percent = n, base = 25,000, amount = decrease in expenses.

Solution $25{,}000 - 23{,}000 = 2{,}000$
Percent · base = amount
$n \cdot 25{,}000 = 2{,}000$
$$n = \frac{2{,}000}{25{,}000}$$
$n = 0.08 = 8\%$
The amount of travel expenses decreased by 8%.

18. Strategy To find the dollar increase:
→Find the price from last year by using the basic percent equation.
Percent = 125% = 1.25, base = n, amount = 1,500
→Subtract last year's price from 1,500.

Solution Percent · base = amount
$1.25n = 1{,}500$
$$n = \frac{1{,}500}{1.25} = 1{,}200$$
$1{,}500 - 1{,}200 = 300$
The dollar increase is $300.

19. Strategy To find the markup, solve the formula $M = r \cdot C$ for M.
$r = 60\%$, $C = 21$

Solution $M = r \cdot C$
$M = 0.60 \cdot 21$
$M = 12.60$
The markup on the cost is $12.60.

20. Strategy To find the markup rate:
→Solve the formula $M = S - C$ for M.
$S = 349$, $C = 225$
→Solve the formula $M = r \cdot C$ for r.

Solution $M = S - C$
$M = 349 - 225$
$M = 124$
$M = r \cdot C$
$124 = r \cdot 225$
$$\frac{124}{225} = r$$
$0.551 \approx r$
The markup rate on the cost is approximately 55.1%.

21. Strategy To find the regular price, solve the formula $S(1-r)R$ for R.
$r = 40\%$, $S = 180$

Solution
$$S = (1-r)R$$
$$180 = (1-0.40)\cdot R$$
$$180 = 0.6R$$
$$\frac{180}{0.6} = R$$
$$300 = R$$
The regular price is \$300.

22. Strategy To find the discount rate:
→Solve the formula $M = r\cdot R$ for r, $M = 51.80$, $R = 185$.

Solution
$$M = r\cdot R$$
$$51.80 = r\cdot 185$$
$$\frac{51.80}{185} = r$$
$$0.28 = r$$
The discount rate is 28%.

23. Strategy To find the simple interest, solve the interest formula $I = Prt$ for I.
$P = 5{,}000$, $t = \frac{9}{12}$, $r = 0.084$

Solution
$$I = Prt$$
$$I = (5{,}000)(0.084)\left(\frac{9}{12}\right)$$
$$I = 315$$
The interest on the loan is \$315.

24. Strategy To find the maturity value:
→Solve the formula $I = Prt$ for I.
$P = 40{,}000$, $r = 0.0925$, $t = \frac{150}{365}$.
→Use the formula for the maturity value of a simple interest loan, $M = P + I$.

Solution
$$I = Prt$$
$$I = (40{,}000)(0.0925)\left(\frac{150}{365}\right)$$
$$I = 1{,}520.55$$
$$M = P + I$$
$$M = 40{,}000 + 1{,}520.55$$
$$M = 41{,}520.55$$
The maturity value is \$41,520.55.

25. Strategy To find the rate, solve the formula $I = Prt$ for r.
$I = 672$, $P = 12{,}000$, $t = \frac{8}{12}$

Solution
$$I = Prt$$
$$672 = 12{,}000(r)\left(\frac{8}{12}\right)$$
$$672 = 8{,}000r$$
$$\frac{672}{8{,}000} = r$$
$$0.084 = r$$
The interest rate is 8.4%.

Cumulative Review Exercises, pages 505–506

1. $a - b$
$102.5 - 77.546 = 24.954$

2. $5^4 = 5\cdot 5\cdot 5\cdot 5$
$= 625$

3. $(4.67)(3.007) = 14.04269$

4. $(2x-3)(2x-5) = 4x^2 - 10x - 6x + 15$
$= 4x^2 - 16x + 15$

5. $3\frac{5}{8} \div 2\frac{7}{12} = \frac{29}{8} \div \frac{31}{12}$
$= \frac{29}{8} \cdot \frac{12}{31}$
$= \frac{29 \cdot 12}{8 \cdot 31}$
$= \frac{29 \cdot 2 \cdot 2 \cdot 3}{2 \cdot 2 \cdot 2 \cdot 31}$
$= \frac{87}{62} = 1\frac{25}{62}$

6. $-2a^2b\left(-3ab^2 + 4a^2b^3 - ab^3\right)$
$= 6a^3b^3 - 8a^4b^4 + 2a^3b^4$

7. Strategy To find the amount, use the basic percent equation.
Percent = 120% = 1.20,
base = 35, amount = n

Solution Percent · base = amount
$1.20 \cdot 35 = n$
$42 = n$
120% of 35 is 42.

8. $x - 2 = -5$
$x - 2 + 2 = -5 + 2$
$x = -3$
The solution is –3.

9. $1.005 \times 10^5 = 100,500$

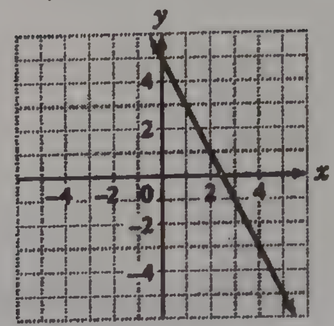
10. $-\frac{5}{8} - \left(-\frac{3}{4}\right) + \frac{5}{6} = -\frac{5}{8} + \frac{3}{4} + \frac{5}{6}$
$= \frac{-15}{24} + \frac{18}{24} + \frac{20}{24}$
$= \frac{-15 + 18 + 20}{24}$
$= \frac{23}{24}$

11. $\dfrac{3 - \frac{7}{8}}{\frac{11}{12} + \frac{1}{4}} = \dfrac{\frac{24}{8} - \frac{7}{8}}{\frac{11}{12} + \frac{3}{12}} = \dfrac{\frac{17}{8}}{\frac{14}{12}} = \dfrac{\frac{17}{8}}{\frac{7}{6}}$
$= \frac{17}{8} \div \frac{7}{6}$
$= \frac{17}{8} \cdot \frac{6}{7}$
$= \frac{17 \cdot 6}{8 \cdot 7} = \frac{51}{28}$
$= 1\frac{23}{28}$

12. $\left(-3a^2b\right)\left(4a^5b^4\right) = (-3 \cdot 4)\left(a^2a^5\right)\left(bb^4\right)$
$= -12a^7b^5$

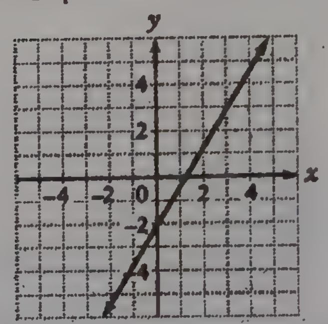
13.

x	y
2	1
1	3
0	5



14.

x	y
3	3
0	–2
–3	–7



15. $\frac{7}{8} \div \frac{5}{16} = \frac{7}{8} \cdot \frac{16}{5}$
$= \frac{7 \cdot 16}{8 \cdot 5}$
$= \frac{7 \cdot 2 \cdot 2 \cdot 2 \cdot 2}{2 \cdot 2 \cdot 2 \cdot 5}$
$= \frac{14}{5} = 2\frac{4}{5}$

16. $4 - (-3) + 5 - 8 = 4 + 3 + 5 + (-8)$
$= 7 + 5 + (-8)$
$= 12 + (-8)$
$= 4$

17. $\frac{3}{4}x = -9$
$\frac{4}{3}\left(\frac{3}{4}x\right) = \frac{4}{3}(-9)$
$x = -12$
The solution is –12.

18. $6x - 9 = -3x + 36$
$6x + 3x - 9 = -3x + 3x + 36$
$9x - 9 = 36$
$9x - 9 + 9 = 36 + 9$
$9x = 45$
$\frac{9x}{9} = \frac{45}{9}$
$x = 5$
The solution is 5.

19. $\frac{322.4 \text{ mi}}{5 \text{ h}} = 64.48 \text{ mph}$

20. $\frac{32}{n} = \frac{5}{7}$
$32 \cdot 7 = n \cdot 5$
$224 = 5n$
$\frac{224}{5} = \frac{5n}{5}$
$44.8 = n$

21. Strategy To find the percent, use the basic percent equation. Percent = n, base = 30, amount = 2.5

Solution Percent · base = amount
$n \cdot 30 = 2.5$
$n = \frac{2.5}{30} \approx 0.0833$
2.5 is approximately 8.3% of 30.

22. Strategy To find the amount, use the basic percent equation. Percent = 42% = 0.42, base = 160, amount = n

Solution Percent · base = amount
$0.42 \cdot 160 = n$
$67.2 = n$
42% of 160 is 67.2.

23. $44 - (-6)^2 \div (-3) + 2 = 44 - 36 \div (-3) + 2$
$= 44 - (-12) + 2$
$= 44 + 12 + 2$
$= 56 + 2$
$= 58$

24. $3(x-2) + 2 = 11$
$3x - 6 + 2 = 11$
$3x - 4 = 11$
$3x - 4 + 4 = 11 + 4$
$3x = 15$
$\frac{3x}{3} = \frac{15}{3}$
$x = 5$
The solution is 5.

25. Strategy To find the fraction, convert 10% to a fraction.

Solution $10\% = 10\left(\frac{1}{100}\right) = \frac{10}{100} = \frac{1}{10}$
$\frac{1}{10}$ of the population aged 75–84 are affected by Alzheimer's Disease.

26. Strategy To find the sale price, solve the formula
$S = (1-r)R$ for S.
$r = 0.36$, $R = 202.50$

Solution $S = (1-r)R$
$S = (1-0.36) \cdot 202.50$
$S = 0.64 \cdot 202.50$
$S = 129.60$
The sale price is $129.60.

27. Strategy To find the cost of the calculator, solve the formula $S = (1+r)C$ for C.
$S = 67.20$, $r = 0.60$

Solution $S = (1+r)C$
$67.20 = (1+0.60)C$
$67.20 = 1.60C$
$\frac{67.20}{1.60} = C$
$42 = C$
The cost of the calculator is $42.

28. Strategy To find the number of games the team will win, write and solve a proportion using n to represent the number of games won.

Solution $\frac{13}{18} = \frac{n}{162}$
$13 \cdot 162 = 18 \cdot n$
$2{,}106 = 18n$
$\frac{2{,}106}{18} = n$
$117 = n$
The team will win 117 games.

29. Strategy To find the amount of weight to lose:
→Add the amount already lost $\left(3\frac{1}{2}+2\frac{1}{4}\right)$.
→Subtract the amount lost from 8.

Solution
$$3\frac{1}{2}+2\frac{1}{4}=3\frac{2}{4}+2\frac{1}{4}$$
$$=5\frac{3}{4}$$
$$8-5\frac{3}{4}=7\frac{4}{4}-5\frac{3}{4}$$
$$=2\frac{1}{4}$$
The wrestler must lose another $2\frac{1}{4}$ lb.

30. Strategy To find the speed, substitute 81 for d in the given formula and solve for v.

Solution
$$v=\sqrt{64d}$$
$$v=\sqrt{64\cdot 81}$$
$$v=\sqrt{64}\cdot\sqrt{81}$$
$$v=8\cdot 9=72$$
$$v=72$$
The speed of the falling object is 72 ft/s.

31. Strategy To convert meters per second to kilometers per hour, use the conversion factors $\frac{3{,}600\text{ s}}{1\text{ h}}$ and $\frac{1\text{ km}}{1{,}000\text{ m}}$.

Solution
$$\frac{60\text{ m}}{6.41\text{ s}}$$
$$=\frac{60\text{ m}}{6.41\text{ s}}\cdot\frac{3{,}600\text{ s}}{1\text{ h}}\cdot\frac{1\text{ km}}{1{,}000\text{ m}}$$
$$\approx 33.70\text{ km/h}$$
The speed was approximately 33.70 km/h.

32. Strategy To find the number of hours worked:
→Subtract the cost of materials (192) from the total cost (1,632).
→Divide the cost of labor by 40.

Solution
$$1{,}632-192=1{,}440$$
$$\frac{1{,}440}{40}=36$$
The plumber worked for 36 h.

33. Strategy To find the resistance:
→Write the basic inverse variation equations, replace the variables by the given values, and solve for k.
→Write the inverse variation equation, replacing k by its value. Substitute 8 for I and solve for R.

Solution
$$I=\frac{k}{R}$$
$$2=\frac{k}{20}$$
$$2\cdot 20=k$$
$$40=k$$
$$I=\frac{40}{R}$$
$$8=\frac{40}{R}$$
$$8R=40$$
$$R=\frac{40}{8}=5$$
The resistance is 5 ohms.

Chapter 9

Section 9.1

Objective A Exercises, pages 519–521

1. The measure of the given angle is approximately 40°. The measure of the angle is between 0° and 90°. The angle is an acute angle.

2. The measure of the given angle is approximately 68°. The measure of the angle is between 0° and 90°. The angle is an acute angle.

3. The measure of the given angle is approximately 115°. The measure of the angle is between 90° and 180°. The angle is an obtuse angle.

4. The measure of the given angle is approximately 122°. The measure of the angle is between 90° and 180°. The angle is an obtuse angle.

5. The measure of the given angle is approximately 90°. The angle is a right angle.

6. The measure of the given angle is approximately 20°. The measure of the angle is between 0° and 90°. The angle is an acute angle.

7. Strategy: Complementary angle are two angles whose sum is 90°. To find the complement, let x represent the complement of a 62° angle. Write an equation and solve for x.

   Solution: $x + 62° = 90°$
   $x = 28°$
   The complement of a 62° angle is a 28° angle.

8. Strategy: Complementary angles are two angles whose sum is 90°. To find the complement, let x represent the complement of a 31° angle. Write an equation and solve for x.

   Solution: $x + 31° = 90°$
   $x = 59°$
   The complement of a 31° angle is a 59° angle.

9. Strategy: Supplementary angles are two angles whose sum is 180°. To find the supplement, let x represent the supplement of a 162° angle. Write an equation and solve for x.

   Solution: $x + 162° = 180°$
   $x = 18°$
   The supplement of a 162° angle is an 18° angle.

10. Strategy: Supplementary angles are two angles whose sum is 180°. To find the supplement, let x represent the supplement of a 72° angle. Write an equation and solve for x.

    Solution: $x + 72° = 180°$
    $x = 108°$
    The supplement of a 72° angle is a 108° angle.

11. $AB + BC + CD = AD$
    $12 + BC + 9 = 35$
    $21 + BC = 35$
    $BC = 14$
    $BC = 14$ cm

12. $AB + BC + CD = AD$
    $21 + 14 + CD = 54$
    $35 + CD = 54$
    $CD = 19$
    $CD = 19$ mm

13. $QR + RS = QS$
    $QR + 3(QR) = QS$
    $7 + 3 \cdot 7 = QS$
    $7 + 21 = QS$
    $28 = QS$
    $QS = 28$ ft

14. $QR + RS = QS$
    $QR + 2(QR) = QS$
    $15 + 2(15) = QS$
    $15 + 30 = QS$
    $45 = QS$
    $QS = 45$ in.

15. $EF + FG = EG$
$EF + \frac{1}{2}(EF) = EG$
$20 + \frac{1}{2}(20) = EG$
$20 + 10 = EG$
$30 = EG$
$EG = 30$ m

16. $EF + FG = EG$
$EF + \frac{1}{3}(EF) = EG$
$18 + \frac{1}{3}(18) = EG$
$18 + 6 = EG$
$24 = EG$
$EG = 24$ cm

17. $\angle LOM + \angle MON = \angle LON$
$53° + \angle MON = 139°$
$\angle MON = 139° - 53°$
$\angle MON = 86°$

18. $\angle LOM + \angle MON = \angle LON$
$\angle LOM + 38° = 85°$
$\angle LOM = 85° - 38°$
$\angle LOM = 47°$

19. Strategy To find the measure of $\angle x$, write an equation using the fact that the sum of the measure of $\angle x$ and 74° is 145°. Solve for $\angle x$.

Solution $\angle x + 74° = 145°$
$\angle x = 71°$
The measure of $\angle x$ is 71°

20. Strategy To find the measure of $\angle x$, write an equation using the fact that the sum of the measure of $\angle x$ and 24° is 87°. Solve for $\angle x$.

Solution $\angle x + 24° = 87°$
$\angle x = 63°$
The measure of $\angle x$ is 63°.

21. Strategy To find the measure of $\angle x$, write an equation using the fact that the sum of the measures of $\angle x$ and $\angle 2x$ is 90°. Solve for $\angle x$.

Solution $x + 2x = 90°$
$3x = 90°$
$x = 30°$
The measure of x is 30°.

22. Strategy To find the measure of $\angle x$, write an equation using the fact that the sum of the measures of $\angle x$ and $\angle 4x$ is 90°. Solve for $\angle x$.

Solution $x + 4x = 90°$
$5x = 90°$
$x = 18°$
The measure of x is 18°.

23. Strategy To find the measure of $\angle x$, write an equation using the fact that the sum of x and $x + 18°$ is 90°. Solve for x.

Solution $x + x + 18° = 90°$
$2x + 18° = 90°$
$2x = 72°$
$x = 36°$
The measure of $\angle x$ is 36°.

24. Strategy To find the measure of $\angle x$, write and equation using the fact that the sum of x and $x + 24°$ is 90°. Solve for x.

Solution $x + x + 24° = 90°$
$2x + 24° = 90°$
$2x = 66°$
$x = 33°$
The measure of $\angle x$ is 33°.

25. Strategy To find the measure of $\angle a$, write an equation using the fact that the sum of the measure of $\angle a$ and 53° is 180°. Solve for $\angle a$.

Solution $\angle a + 53° = 180°$
$\angle a = 127°$
The measure of $\angle a$ is 127°.

26. Strategy To find the measure of $\angle a$, write an equation using the fact that the sum of the measure of $\angle a$ and 127° is 180°. Solve for $\angle a$.

Solution $\angle a + 127° = 180°$
$\angle a = 53°$
The measure of $\angle a$ is 53°.

27. Strategy The sum of the measures of the three angles shown is 360°. To find $\angle a$, write an equation and solve for $\angle a$.

Solution $\angle a + 76° + 168° = 360°$
$\angle a + 244° = 360°$
$\angle a = 116°$
The measure of $\angle a$ is 116°.

28. Strategy The sum of the measures of the three angles shown is 360°. To find $\angle a$, write an equation and solve for $\angle a$.

Solution $\angle a + 67° + 172° = 360°$
$\angle a + 239° = 360°$
$\angle a = 121°$
The measure of $\angle a$ is 121°.

29. Strategy The sum of the measures of the three angles shown is 180°. To find x, write an equation and solve for x.

Solution $3x + 4x + 2x = 180°$
$9x = 180°$
$x = 20°$
The measure of x is 20°.

30. Strategy The sum of the measures of the three angles shown is 180°. To find x, write an equation and solve for x.

Solution $4x + 6x + 2x = 180°$
$12x = 180°$
$x = 15°$
The measure of x is 15°.

31. Strategy The sum of the measures of the three angles shown is 180°. To find x, write an equation and solve for x.

Solution $5x + (x + 20°) + 2x = 180°$
$8x + 20° = 180°$
$8x = 160°$
$x = 20°$
The measure of x is 20°.

32. Strategy The sum of the measures of the three angles shown is 180°. To find x, write an equation and solve for x.

Solution $3x + (x + 36°) + 4x = 180°$
$8x + 36° = 180°$
$8x = 144°$
$x = 18°$
The measure of x is 18°.

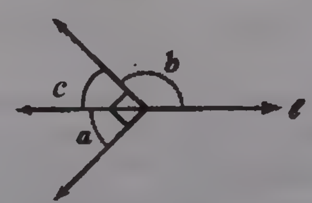
33. Strategy The sum of the measures of the four angles shown is 360°. To find x, write an equation and solve for x.

Solution $3x + 4x + 6x + 5x = 360°$
$18x = 360°$
$x = 20°$
The measure of x is 20°.

34. Strategy The sum of the measures of the four angles shown is 360°. To find x, write an equation and solve for x.

Solution $x + 2x + 3x + 2x = 360°$
$8x = 360°$
$x = 45°$
The measure of x is 45°.

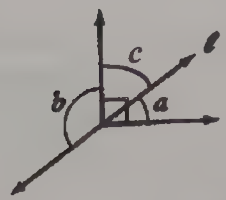
35. Strategy



To find the measure of $\angle b$:
→Use the fact that $\angle a$ and $\angle c$ are complementary angles.
→Find $\angle b$ by using the fact that $\angle c$ and $\angle b$ are supplementary angles.

Solution $\angle a + \angle c = 90°$
$51° + \angle c = 90°$
$\angle c = 39°$
$\angle b + \angle c = 180°$
$\angle b + 39° = 180°$
$\angle b = 141°$
The measure of $\angle b$ is 141°.

36. Strategy



To find the measure of $\angle b$:
→Use the fact that $\angle a$ and $\angle c$ are complementary angles.
→Find $\angle b$ by using the fact that $\angle b$ and $\angle c$ are supplementary angles.

Solution
$\angle a + \angle c = 90°$
$38° + \angle c = 90°$
$\angle c = 52°$
$\angle b + \angle c = 180°$
$\angle b + 52° = 180°$
$\angle b = 128°$
The measure of $\angle b$ is 128°.

Objective B Exercises, pages 521–522

37. Strategy The angles labeled are adjacent angles of intersecting lines and are, therefore, supplementary angles. To find x, write an equation and solve for x.

Solution
$x + 74° = 180°$
$x = 106°$
The measure of x is 106°.

38. Strategy The angles labeled are adjacent angles of intersecting lines and are, therefore, supplementary angles. To find x, write an equation and solve for x.

Solution
$x + 131° = 180°$
$x = 49°$
The measure of x is 49°.

39. Strategy The angles labeled are vertical angles and are, therefore, equal. To find x, write an equation and solve for x.

Solution
$5x = 3x + 22°$
$2x = 22°$
$x = 11°$
The measure of x is 11°.

40. Strategy The angles labeled are vertical angles and are, therefore, equal. To find x, write an equation and solve for x.

Solution
$7x = 4x + 36°$
$3x = 36°$
$x = 12°$
The measure of x is 12°.

41. Strategy
→To find the measure of $\angle a$, use the fact that corresponding angles of parallel lines are equal.
→To find the measure of $\angle b$, use the fact that adjacent angles of intersecting lines are supplementary.

Solution
$\angle a = 38°$
$\angle b + \angle a = 180°$
$\angle b + 38° = 180°$
$\angle b = 142°$
The measure of $\angle a$ is 38°.
The measure of $\angle b$ is 142°.

42. Strategy
→To find the measure of $\angle a$, use the fact that alternate interior angles of parallel lines are equal.
→To find the measure of $\angle b$, use the fact that adjacent angles of intersecting lines are supplementary.

Solution
$\angle a = 122°$
$\angle b + \angle a = 180°$
$\angle b + 122° = 180°$
$\angle b = 58°$
The measure of $\angle a$ is 122°.
The measure of $\angle b$ is 58°.

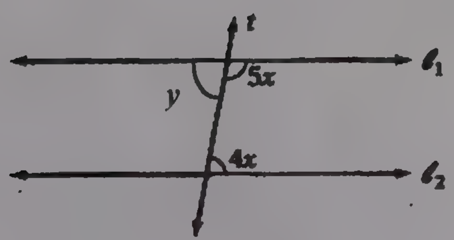
43. Strategy
→To find the measure of $\angle a$, use the fact that alternate interior angles of parallel lines are equal.
→To find the measure of $\angle b$, use the fact that adjacent angles of intersecting lines are supplementary.

Solution $\angle a = 47°$
$\angle a + \angle b = 180°$
$47° + \angle b = 180°$
$\angle b = 133°$
The measure of $\angle a$ is 47°.
The measure of $\angle b$ is 133°.

44. Strategy →To find the measure of $\angle b$, use the fact that alternate interior angles of parallel lines are equal.
→To find the measure of $\angle a$, use the fact that adjacent angles of intersecting lines are supplementary.

Solution $\angle b = 136°$
$\angle a + \angle b = 180°$
$\angle a + 136° = 180°$
$\angle a = 44°$
The measure of $\angle a$ is 44°.
The measure of $\angle b$ is 138°.

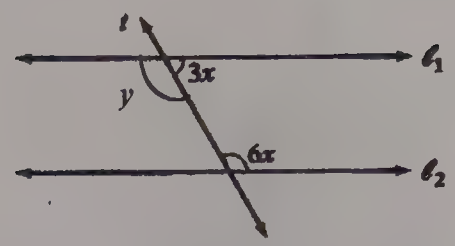
45. Strategy



$4x = y$ because alternate interior angles have the same measure. $y + 5x = 180°$ because adjacent angles of intersecting lines are supplementary. Substitute $4x$ for y and solve for x.

Solution $4x + 5x = 180°$
$9x = 180°$
$x = 20°$
The measure of x is 20°.

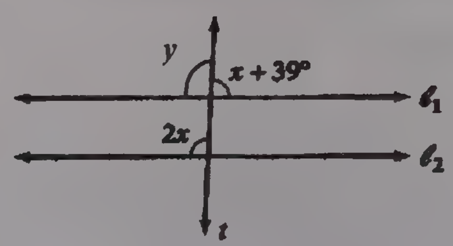
46. Strategy



$6x = y$ because alternate interior angles have the same measure. $y + 3x = 180°$ because adjacent angles of intersecting lines are supplementary. Substitute $6x$ for y and solve for x.

Solution $6x + 3x = 180°$
$9x = 180°$
$x = 20°$
The measure of x is 20°.

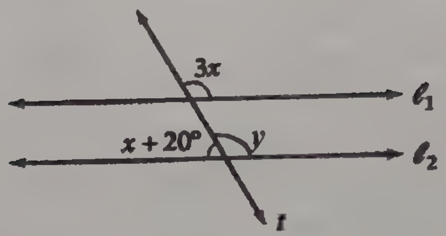
47. Strategy



$y = 2x$ because corresponding angles have the same measure. $y + x + 39° = 180°$ because adjacent angles of intersecting lines are supplementary angles. Substitute $2x$ for y and solve for x.

Solution $2x + x + 39° = 180°$
$3x + 39° = 180°$
$3x = 141°$
$x = 47°$
The measure of x is 47°.

48. Strategy

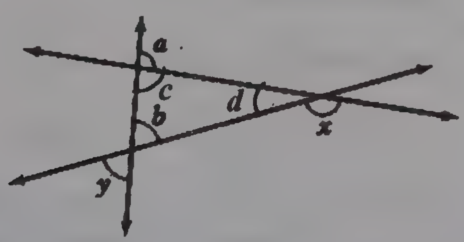


$y = 3x$ because corresponding angles have the same measure. $y + x + 20° = 180°$ because adjacent angles of intersecting lines are supplementary angles. Substitute $3x$ for y and solve for x.

Solution
$3x + x + 20° = 180°$
$4x + 20° = 180°$
$4x = 160°$
$x = 40°$
The measure of x is 40°.

Objective C Exercises, pages 522–524

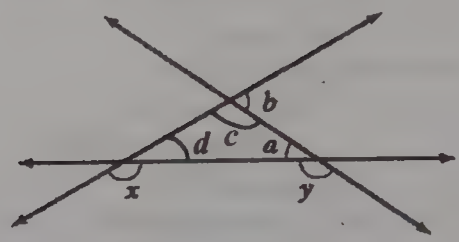
49. Strategy



→To find the measure of $\angle y$, use the fact that $\angle b$ and $\angle y$ are vertical angles.
→To find the measure of $\angle x$:
Find the measure of $\angle c$ by using the fact that the sum of an interior and exterior angle is 180°.
Find the measure of $\angle d$ by using the fact that the sum of the interior angles of a triangle is 180°.
Find the measure of $\angle x$, by using the fact that the sum of an interior and exterior angle is 180°.

Solution
$\angle y = \angle b = 70°$
$\angle a + \angle c = 180°$
$95° + \angle c = 180°$
$\angle c = 85°$
$\angle b + \angle c + \angle d = 180°$
$70° + 85° + \angle d = 180°$
$155° + \angle d = 180°$
$\angle d = 25°$
$\angle d + \angle x = 180°$
$25° + \angle x = 180°$
$\angle x = 155°$
The measure of $\angle x$ is 155°.
The measure of $\angle y$ is 70°.

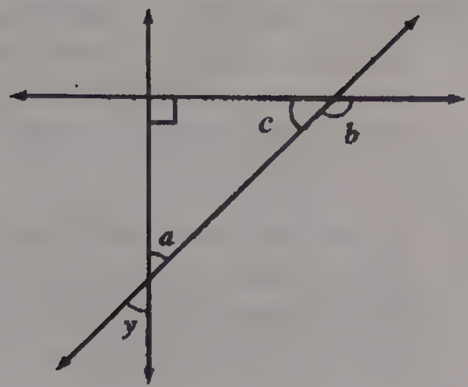
50. Strategy



→To find the measure of $\angle y$, use the fact that sum of an interior angle and exterior angle is 180°.
→To find the measure of $\angle x$:
Find the measure of $\angle c$ by using the fact that the sum of the interior angles of a triangle is 180°.
Find the measure of $\angle x$ by using the fact that the sum of an interior and exterior angle is 180°.

Solution
$\angle a + \angle y = 180°$
$35° + \angle y = 180°$
$\angle y = 145°$
$\angle b + \angle c = 180°$
$55° + \angle c = 180°$
$\angle c = 125°$
$\angle a + \angle c + \angle d = 180°$
$35° + 125° + \angle d = 180°$
$160° + \angle d = 180°$
$\angle d = 20°$
$\angle x + \angle d = 180°$
$\angle x + 20° = 180°$
$\angle x = 160°$
The measure of $\angle x$ is 160°.
The measure of $\angle y$ is 145°.

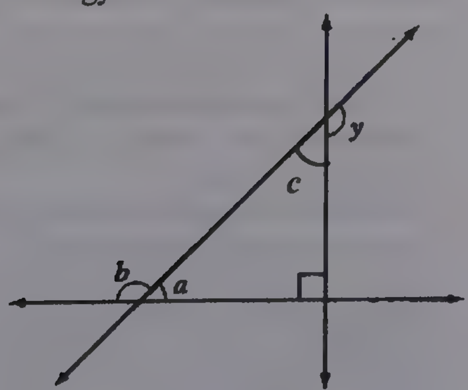
51. Strategy



→To find the measure of $\angle a$, use the fact that $\angle a$ and $\angle y$ are vertical angles.
→To find the measure of $\angle b$:
Find the measure of $\angle c$ by using the fact that the sum of the interior angles of a triangle is 180°.
Find the measure of $\angle b$ by using the fact that the sum of an interior and exterior angle is 180°.

Solution
$\angle a = \angle y = 45°$
$\angle a + \angle c + 90° = 180°$
$45° + \angle c + 90° = 180°$
$\angle c + 135° = 180°$
$\angle c = 45°$
$\angle c + \angle b = 180°$
$45° + \angle b = 180°$
$\angle b = 135°$
The measure of $\angle a$ is 45°.
The measure of $\angle b$ is 135°.

52. Strategy



→To find the measure of $\angle a$:
Find the measure of $\angle c$ by using the fact that the sum of an interior and exterior angle is 180°.
Find the measure of $\angle a$ by using the fact that the sum of the measures of the interior angles of a triangle is 180°.
→To find the measure of $\angle b$, use the fact that the sum of an interior and exterior angle is 180°.

Solution
$\angle c + \angle y = 180°$
$\angle c + 130° = 180°$
$\angle c = 50°$
$\angle a + \angle c + 90° = 180°$
$\angle a + 50° + 90° = 180°$
$\angle a + 140° = 180°$
$\angle a = 40°$
$\angle a + \angle b = 180°$
$40° + \angle b = 180°$
$\angle b = 140°$
The measure of $\angle a$ is 40°.
The measure of $\angle b$ is 140°.

53. Strategy
To find the measure of $\angle BOC$, use the fact that the sum of the measure of the angles x, $\angle AOB$, and $\angle AOB$ is 180°.
Since $\overline{AO} \perp \overline{OB}$,
$\angle AOB = 90°$

Solution
$x + \angle AOB + \angle BOC = 180°$
$x + 90° + \angle BOC = 180°$
$\angle BOC = 90° - x$
The measure of $\angle BOC$ is $90° - x$.

54. Strategy
To find the measure of $\angle AOC$, use the fact that the sum of the measures of the angles $x + 15°$, $\angle AOC$, and $\angle AOB$ is 180°.
Since $\overline{AO} \perp \overline{OB}$, $\angle AOB = 90°$.

Solution
$(x + 15°) + \angle AOC + \angle AOB$
$= 180°$
$x + 15° + \angle AOC + 90°$
$= 180°$
$x + \angle AOC + 105° = 180°$
$\angle AOC = 75° - x$
The measure of $\angle AOC$ is $75° - x$.

55. Strategy To find the measure of the third angle, use the fact that the sum of the measures of the interior angles of a triangle is 180°. Write an equation using x to represent the measure of the third angle. Solve the equation for x.

Solution $x + 90° + 30° = 180°$
$x + 120° = 180°$
$x = 60°$
The measure of the third angle is 60°.

56. Strategy To find the measure of the third angle, use the fact that the sum of the measures of the interior angles of a triangle is 180°. Write an equation using x to represent the measure of the third angle. Solve the equation for x.

Solution $x + 45° + 90° = 180°$
$x + 135° = 180°$
$x = 45°$
The measure of the third angle is 45°.

57. Strategy To find the measure of the third angle, use the fact that the sum of the measures of the interior angles of a triangle is 180°. Write an equation using x to represent the measure of the third angle. Solve the equation for x.

Solution $x + 42° + 103° = 180°$
$x + 145° = 180°$
$x = 35°$
The measure of the third angle is 35°.

58. Strategy To find the measure of the third angle, use the fact that the sum of the measures of the interior angles of a triangle is 180°. Write an equation using x to represent the measure of the third angle. Solve the equation for x.

Solution $x + 13° + 65° = 180°$
$x + 78° = 180°$
$x = 102°$
The measure of the third angle is 102°.

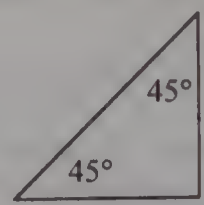
Critical Thinking 9.1, page 524

59. a. The smallest possible whole number of degrees in an angle of a triangle is 1°. For example, the other 2 angles could measure 100° and 79°, and 100° + 79° + 1° = 180°.

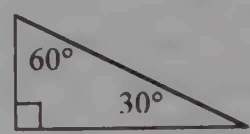
b. The largest possible whole number of degrees in an angle of a triangle is 179°. For example, the other two angles could measure 0.5°, and 0.5° + 0.5° + 179° = 180°.

60. The three angles a, b, and c, lie along a straight line; they form a straight line. A straight angle measures 180°.

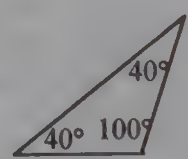
61. a.



b.



c.



62. a. If two lines are parallel to a third line, they must be parallel to each other. The statement is always true.

b. A triangle must contain 3 acute angles or 2 acute and 1 obtuse angle. The statement is always true.

c. Two angles that are on opposite sides of the intersection of two lines are vertical angles. Vertical angles have the same measure.
If two vertical angles each measure 50°, then the angles are not complementary angles. If two vertical angles each measure 45°, then the sum of the two angles is 90°, and they are complementary angles. The statement is sometimes true.

63. Because the sum of the measures of an interior and an exterior angle is 180°:
$\angle a + \angle y = 180°$
$\angle b + \angle z = 180°$
$\angle c + \angle x = 180°$
Adding these 3 equations results in
$\angle a+\angle y+\angle b+\angle z+\angle c+\angle x=180°+180°+180$
$\angle a+\angle y + \angle b + \angle z + \angle c + \angle x = 540°$
Because the sum of the measures of the interior angles of a triangle is 180°:
$\angle a + \angle b + \angle c = 180°$
$(\angle a+\angle b + \angle c) + (\angle y + \angle z + \angle x) = 540°$
$180° + (\angle y + \angle z + \angle x) = 540°$
$\angle y + \angle z + \angle x = 360°$
$\angle x + \angle y + \angle z = 360°$
The sum of the measures of angles x, y, and z is 360°.

Section 9.2

Objective A Exercises, pages 535—538

1. The polygon has 6 sides.
The polygon is a hexagon.

2. The polygon has 7 sides.
The polygon is a heptagon.

3. The polygon has 5 sides.
The polygon is a pentagon.

4. The polygon has 4 sides.
The polygon is a quadrilateral.

5. The triangle has no sides equal.
The triangle is a scalene triangle.

6. The triangle has two sides equal.
The triangle is a isosceles triangle.

7. The triangle has three sides equal.
The triangle is an equilateral triangle.

8. The triangle has no sides equal.
The triangle is a scalene triangle.

9. The triangle has one obtuse angle.
The triangle is an obtuse triangle.

10. The triangle has one right triangle.
The triangle is a right triangle.

11. The triangle has three acute angles.
The triangle is an acute triangle.

12. The triangle has one obtuse angle.
The triangle is an obtuse triangle.

13. Strategy: To find the perimeter, use the formula for the perimeter of a triangle. Substitute 12 for a, 20 for b, and 24 for c. Solve for P.

Solution:
$P = a + b + c$
$P = 12 + 20 + 24$
$P = 56$
The perimeter is 56 in.

14. Strategy: To find the perimeter, use the formula for the perimeter of a rectangle. Substitute 11 for L and 7 for W. Solve for P.

Solution:
$P = 2L + 2W$
$P = 2 \cdot 11 + 2 \cdot 7$
$P = 22 + 14$
$P = 36$
The perimeter is 36 cm.

15. Strategy: To find the perimeter, use the formula for the perimeter of a square. Substitute 3.5 for s and solve for P.

Solution:
$P = 4s$
$P = 4 \cdot 3.5$
$P = 14$
The perimeter is 14 ft.

16. Strategy: To find the perimeter, add the measure of each side of the quadrilateral.

Solution:
$P = 12 + 9 + 8 + 10$
$P = 39$
The perimeter is 39 m.

17. Strategy: To find the perimeter, use the formula for the perimeter of a rectangle. Substitute 13 for L and 10.5 for W. Solve for P.

Solution:
$P = 2L + 2W$
$P = 2 \cdot 13 + 2 \cdot 10.5$
$P = 26 + 21$
$P = 47$
The perimeter is 47 mi.

18. Strategy To find the perimeter, use the formula for the perimeter of a square. Substitute $2\frac{1}{2}$ for x. Solve for P.

Solution
$P = 4s$
$P = 4 \cdot 2\frac{1}{2}$
$P = 4 \cdot \frac{5}{2}$
$P = 10$
The perimeter is 10 in.

19. Strategy To find the circumference, use the circumference formula that involves the radius. For the exact answer, leave the answer in terms of π. For an approximation, use the π key on a calculator. $r = 4$.

Solution
$C = 2\pi r$
$C = 2\pi(4)$
$C = 8\pi$
$C \approx 25.13$
The circumference is 8π cm.
The circumference is approximately 25.13 cm.

20. Strategy To find the circumference, use the circumference formula that involves the radius. For the exact answer, leave the answer in terms of π. For an approximation, use the π key on a calculator. $r = 12$.

Solution
$C = 2\pi r$
$C = 2\pi(12)$
$C = 24\pi$
$C \approx 75.40$
The circumference is 24π m.
The circumference is approximately 75.40 m.

21. Strategy To find the circumference, use the circumference formula that involves the radius. For the exact answer, leave the answer in terms of π. For an approximation use the π key on a calculator. $r = 5.5$.

Solution
$C = 2\pi r$
$C = 2\pi(5.5)$
$C = 11\pi$
$C \approx 34.56$
The circumference is 11π mi.
The circumference is approximately 34.56 mi.

22. Strategy To find the circumference, use the circumference formula that involves the diameter. For the exact answer, leave the answer in term of π. For an approximation, use the π key on a calculator. $d = 18$.

Solution
$C = \pi d$
$C = \pi(18)$
$C = 18\pi$
$C \approx 56.55$
The circumference is 18π in.
The circumference is approximately 56.55 in.

23. Strategy To find the circumference, use the circumference formula that involves the diameter. For the exact answer leave the answer in terms of π. For an approximation use the π key on a calculator. $d = 17$.

Solution
$C = \pi d$
$C = \pi(17)$
$C = 17\pi$
$C \approx 53.41$
The circumference is 17π ft.
The circumference is approximately 53.41 ft.

24. Strategy To find the circumference, use the circumference formula that involves the diameter. For the exact answer leave the answer in terms of π. For an approximation use the π key on a calculator. $d = 6.6$.

Solution $C = \pi d$
$C = \pi(6.6)$
$C = 6.6\pi$
$C \approx 20.73$
The circumference is 6.6π km.
The circumference is approximately 20.73 km.

25. Strategy To find the perimeter, use the formula for the perimeter of a triangle. Substitute 3.8 for *a*, 5.2 for *b*, and 8.4 for *c*. Solve for *P*.

Solution $P = a + b + c$
$P = 3.8 + 5.2 + 8.4$
$P = 17.4$
The perimeter is 17.4 cm.

26. Strategy To find the perimeter, use the formula for the perimeter of a triangle. Substitute 7.5 for *a*, 6.1 for *b*, and 4.9 for *c*. Solve for *P*.

Solution $P = a + b + c$
$P = 7.5 + 6.1 + 4.9$
$P = 18.5$
The perimeter is 18.5 m.

27. Strategy To find the perimeter, use the formula for the perimeter of a triangle. Substitute $2\frac{1}{2}$ for *a* and *b*, and 3 for *c*. Solve for *P*.

Solution $P = a + b + c$
$P = 2\frac{1}{2} + 2\frac{1}{2} + 3$
$P = 8$
The perimeter is 8 cm.

28. Strategy To find the perimeter, use the formula for the perimeter of a triangle. Substitute $4\frac{1}{2}$ for *a*, *b*, and *c*. Solve for *P*.

Solution $P = a + b + c$
$P = 4\frac{1}{2} + 4\frac{1}{2} + 4\frac{1}{2}$
$P = 13\frac{1}{2}$
The perimeter is $13\frac{1}{2}$ in.

29. Strategy To find the perimeter, use the formula for the perimeter of a rectangle. Substitute 8.5 for *L* and 3.5 for *W*. Solve for *P*.

Solution $P = 2L + 2W$
$P = 2(8.5) + 2(3.5)$
$P = 17 + 7$
$P = 24$
The perimeter is 24 m.

30. Strategy To find the perimeter, use the formula for the perimeter of a rectangle. Substitute $5\frac{1}{2}$ for *L* and 4 for *W*. Solve for *P*.

Solution $P = 2L + 2W$
$P = 2\left(5\frac{1}{2}\right) + 2(4)$
$P = 11 + 8$
$P = 19$
The perimeter is 19 ft.

31. Strategy To find the perimeter, use the formula for the perimeter of a square. Substitute 12.2 for *s*. Solve for *P*.

Solution $P = 4s$
$P = 4(12.2)$
$P = 48.8$
The perimeter is 48.8 cm.

32. Strategy To find the perimeter, use the formula for the perimeter of a square. Substitute 0.5 for *s*. Solve for *P*.

Solution $P = 4s$
$P = 4(0.5)$
$P = 2$
The perimeter is 2 m.

33. Strategy To find the perimeter, multiply the measure of one of the equal sides (3.5) by 5.

Solution $P = 5(3.5)$
$P = 17.5$
The perimeter is 17.5 in.

34. Strategy To find the perimeter, multiply the measure of one of the equal sides (8.5) by 6.

Solution $P = 6(8.5)$
$P = 51$
The perimeter is 51 cm.

35. Strategy To find the circumference, use the circumference formula that involves the diameter. Leave the answer in terms of π. $d = 1.5$

Solution $C = \pi d$
$C = \pi(1.5)$
$C = 1.5\pi$
The circumference is 1.5π in.

36. Strategy To find the circumference, use the circumference formula that involves the diameter. An approximation is asked for; use the π key on a calculator. $d = 4.2$

Solution $C = \pi d$
$C = \pi(4.2)$
$C \approx 13.19$
The circumference is approximately 13.19 ft.

37. Strategy To find the circumference, use the circumference formula that involves the radius. An approximation is asked for; use the π key on a calculator. $r = 36$.

Solution $C = 2\pi r$
$C = 2\pi(36)$
$C = 72\pi$
$C \approx 226.19$
The circumference is approximately 226.19 cm.

38. Strategy To find the circumference, use the circumference formula that involves the radius. Leave the answer in terms of π. $r = 2.5$

Solution $C = 2\pi r$
$C = 2\pi(2.5)$
$C = 5\pi$
The circumference is 5π m.

39. Strategy To find the amount of fencing, use the formula for the perimeter of a rectangle. Substitute 18 for L and 12 for W. Solve for P.

Solution $P = 2L + 2W$
$P = 2(18) + 2(12)$
$P = 36 + 24$
$P = 60$
The perimeter of the garden is 60 ft.

40. Strategy To find the amount of binding, use the formula for the perimeter of a rectangle. Substitute 8.5 for L and 3.5 for W. Solve for P.

Solution $P = 2L + 2W$
$P = 2(8.5) + 2(3.5)$
$P = 17 + 7$
$P = 24$
24 m of binding are needed.

41. Strategy To find the amount to be nailed down, use the formula for the perimeter of a rectangle. Substitute 12 for L and 10 for W. Solve for P.

Solution $P = 2L + 2W$
$P = 2(12) + 2(10)$
$P = 24 + 20$
$P = 44$
44 ft of carpet must be nailed down.

42. Strategy To find the amount of fencing, use the formula for the perimeter of a rectangle. Substitute 55 for L and 47 W. Solve for P.

Solution $P = 2L + 2\text{W}$
$P = 2(55) + 2(47)$
$P = 110 + 94$
$P = 204$
204 yd of fencing are needed to surround the park.

43. Strategy To find the length, use the formula for the perimeter of a rectangle. Substitute 440 for P and 100 for W. Solve for L.

Solution $P = 2L + 2W$
$440 = 2L + 2(100)$
$440 = 2L + 200$
$240 = 2L$
$120 = L$
The length is 120 ft.

44. Strategy To find the width, use the formula for the perimeter of a rectangle. Substitute 64 for P and 20 for L. Solve for W.

Solution $P = 2L + 2W$
$64 = 2(20) + 2W$
$64 = 40 + 2W$
$24 = 2W$
$12 = W$
The width is 12 ft.

45. Strategy To find the third side of the banner, use the formula for the perimeter of a triangle. Substitute 46 for P, 18 for a, and 18 for b. Solve for c.

Solution $P = a + b + c$
$46 = 18 + 18 + c$
$46 = 36 + c$
$10 = c$
The third side of the banner is 10 in.

46. Strategy To find the length of each side of an equilateral triangle, use the formula for the perimeter of a triangle. Since $a = b = c$, the formula $P = a + b + c$ becomes $P = 3a$. Substitute 13.2 for P. Solve for a.

Solution $P = 3a$
$13.2 = 3a$
$4.4 = a$
Each side of the equilateral triangle is 4.4 cm.

47. Strategy To find the length of each side, use the formula for the perimeter of a square. Substitute 48 for P. Solve for s.

Solution $P = 4s$
$48 = 4s$
$12 = s$
The length of each side is 12 in.

48. Strategy To find the length of each edge, use the formula for the perimeter of a square. Substitute 32 for P. Solve for s.

Solution $P = 4s$
$32 = 4s$
$8 = s$
The length of each edge is 8 ft.

49. Strategy To find the length of the diameter, use the circumference formula that involves the diameter. An approximation is asked for; use the π key on a calculator. $C = 8$.

Solution $C = \pi d$
$8 = \pi d$
$\frac{8}{\pi} = d$
$2.55 \approx d$
The diameter is approximately 2.55 cm.

50. Strategy To find the length of the radius, use the circumference formula that involves the radius. An approximation is asked for, use the π key on a calculator. $C = 15$.

Solution $C = 2\pi r$
$15 = 2\pi r$
$7.5 = \pi r$
$\frac{7.5}{\pi} = r$
$2.39 \approx r$
The radius is approximately 2.39 in.

51. Strategy To find the length of molding, use the circumference formula that involves the diameter. An approximation is asked for; use the π key on a calculator. $d = 4.2$.

Solution $C = \pi d$
$C = \pi(4.2)$
$C \approx 13.19$
The length of molding is approximately 13.19 ft.

52. Strategy To find the amount of binding, use the circumference formula that involves the diameter. An approximation is asked for; use the π key on a calculator. $d = 3$.

Solution
$C = \pi d$
$C = \pi(3)$
$C \approx 9.42$
The length of binding is approximately 9.42 m.

53. Strategy To find the distance:
→Convert the diameter to feet.
→Multiply the circumference by 8. An approximation is asked for; use the π key on a calculator.

Solution
$24 \text{ in.} = 24 \text{ in.} \cdot \frac{1 \text{ ft}}{12 \text{ in.}} = 2 \text{ ft}$
distance $= 8C$
distance $= 8\pi d$
distance $= 8\pi(2)$
distance $= 16\pi$
distance ≈ 50.27
The bicycle travels approximately 50.27 ft.

54. Strategy
→Convert the diameter to feet.
→Multiply the circumference by 12. An approximation is asked for; use the π key on a calculator.

Solution
$12 \text{ in.} = 12 \text{ in.} \cdot \frac{1 \text{ ft}}{12 \text{ in.}} = 1 \text{ ft}$
distance $= 12C$
distance $= 12\pi d$
distance $= 12\pi(1)$
distance $= 12\pi$
distance ≈ 37.70
The tricycle travels approximately 37.70 ft.

55. Strategy To find the circumference of the earth, use the circumference formula that involves the radius. An approximation is asked for; use the π key on a calculator. $r = 6{,}356$.

Solution
$C = 2\pi r$
$C = 2\pi(6{,}356)$
$C = 12{,}712\pi$
$C \approx 39{,}935.93$
The circumference of the earth is approximately 39,935.93 km.

56. Strategy To find the number of packages need:
→Use the formula for the perimeter of a rectangle to find the perimeter.
→Convert the length from inches to feet.
→Divide the perimeter by the length that one package will bind (15).

Solution
$P = 2L + 2W$
$P = 2(72) + 2(45)$
$P = 144 + 90 = 234$
$234 \text{ in} = 234 \text{ in} \cdot \frac{1 \text{ ft}}{12 \text{ in}} = 19.5 \text{ ft}$
$\frac{19.5}{15} = 1.3$
Because a portion of a second package is needed, 2 packages of binding are needed.

Objective B Exercises, pages 538–542

57. Strategy To find the area, use the formula for the area of a rectangle. Substitute 12 for L and 5 for W. Solve for A.

Solution
$A = LW$
$A = 12(5)$
$A = 60$
The area is 60 ft^2.

58. Strategy To find the area, use the formula for the area of parallelogram. Substitute 8 for b and 6 for h. Solve for A.

Solution
$A = bh$
$A = 8(6)$
$A = 48$
The area is 48 m^2.

59. Strategy To find the area, use the formula for the area of the square. Substitute 4.5 for s. Solve for A.

Solution
$A = s^2$
$A = (4.5)^2$
$A = 20.25$
The area is 20.25 in^2.

60. Strategy To find the area, use the formula for the area of the triangle. Substitute 20 for b and 12 for h. Solve for A.

Solution
$A = \frac{1}{2}bh$
$A = \frac{1}{2}(20)(12)$
$A = 120$
The area is 120 in^2.

61. Strategy To find the area, use the formula for the area of a triangle. Substitute 42 for b and 26 for h. Solve for A.

Solution
$A = \frac{1}{2}bh$
$A = \frac{1}{2}(42)(26)$
$A = 546$
The area is 546 ft.^2.

62. Strategy To find the area, use the formula for the area of a trapezoid. Substitute 16 for b_1, 12 for b_2, and 8 for h. Solve for A.

Solution
$A = \frac{1}{2}h(b_1 + b_2)$
$A = \frac{1}{2} \cdot 8(16 + 12)$
$A = 112$
The area is 112 cm^2.

63. Strategy To find the area, use the formula for the area of a circle. Substitute 4 for r. Solve for A. For the exact answer, leave the answer in terms of π. For an approximation, use the π key on a calculator.

Solution
$A = \pi r^2$
$A = \pi(4)^2$
$A = 16\pi$
$A \approx 50.27$
The area is 16π cm^2.
The area is approximately 50.27 cm^2.

64. Strategy To find the area, use the formula for the area of a circle. Substitute 12 for r. Solve for A. For the exact answer leave the answer in terms of π. For an approximation, use the π key on a calculator.

Solution
$A = \pi r^2$
$A = \pi(12)^2$
$A = 144\pi$
$A \approx 452.39$
The area is 144π m^2.
The area is approximately 452.39 m^2.

65. Strategy To find the area, use the formula for the area of a circle. Substitute 5.5 for r. Solve for A. For the exact answer, leave the answer in terms of π. For an approximation, use the π key on a calculator.

Solution
$A = \pi r^2$
$A = \pi(5.5)^2$
$A = 30.25\pi$
$A \approx 95.03$
The area is 30.25π mi^2.
The area is approximately 95.03 mi^2.

66. Strategy To find the area:
→Find the radius of the circle.
→Use the formula for the area of a circle. For an exact answer, leave the answer in terms of π. For an approximation, use the π key on a calculator.

Solution
$r = \frac{1}{2}d = \frac{1}{2}(18) = 9$
$A = \pi r^2$
$A = \pi(9)^2$
$A = 81\pi$
$A \approx 254.47$
The area is 81π in^2.
The area is approximately 254.47 in^2.

67. Strategy To find the area:
→Find the radius of the circle.
→Use the formula for the area of a circle. For an exact answer, leave the answer in terms of π. For an approximation, use the π key on a calculator.

Solution
$r = \frac{1}{2}d = \frac{1}{2}(17) = 8.5$
$A = \pi r^2$
$A = \pi(8.5)^2$
$A = 72.25\pi$
$A \approx 226.98$
The area is 72.25π ft^2.
The area is approximately 226.98 ft^2.

68. Strategy To find the area:
→Find the radius of the circle.
→Use the formula for the area of a circle. For an exact answer, leave the answer in terms of π. For an approximation, use the π key on a calculator.

Solution
$r = \frac{1}{2}d = \frac{1}{2}(6.6) = 3.3$
$A = \pi r^2$
$A = \pi(3.3)^2$
$A = 10.89\pi$
$A \approx 34.21$
The area is 10.89π km^2.
The area is approximately 34.21 km^2.

69. Strategy To find the area, use the formula for the area of a square. Substitute 12.5 for s. Solve for A.

Solution
$A = s^2$
$A = (12.5)^2$
$A = 156.25$
The area is 156.25 cm^2.

70. Strategy To find the area, use the formula for the area of a square. Substitute $3\frac{1}{2}$ for s.

Solution
$A = s^2$
$A = \left(3\frac{1}{2}\right)^2$
$A = \frac{49}{4} = 12.25$
The area is 12.25 in^2.

71. Strategy To find the area, use the formula for the area of a rectangle. Substitute 38 for L and 15 for W. Solve for A.

Solution
$A = LW$
$A = 38(15)$
$A = 570$
The area is 570 in^2.

72. Strategy To find the area, use the formula for the area of a rectangle. Substitute 6.5 for L and 3.8 for W. Solve for A.

Solution
$A = LW$
$A = 6.5(3.8)$
$A = 24.7$
The area is 24.7 m^2.

73. Strategy To find the area, use the formula for the area of a parallelogram. Substitute 16 for b and 12 for h. Solve for A.

Solution
$A = bh$
$A = 16(12)$
$A = 192$
The area is 192 in^2.

74. Strategy To find the area, use the formula for the area of a parallelogram. Substitute 5.2 for b and 3.4 for h. Solve for A.

Solution
$A = bh$
$A = 5.2(3.4)$
$A = 17.68$
The area is 17.68 m^2.

75. Strategy To find the area, use the formula for the area of a triangle. Substitute 6 for b and 4.5 for h. Solve for A.

Solution
$A = \frac{1}{2}bh$
$A = \frac{1}{2}(6)(4.5)$
$A = 13.5$
The area is 13.5 ft^2.

76. Strategy To find the area, use the formula for the area of a triangle. Substitute 5 for b and 4.2 for h. Solve for A.

Solution
$A = \frac{1}{2}bh$
$A = \frac{1}{2}(5)(4.2)$
$A = 10.5$
The area is 10.5 cm^2.

77. Strategy To find the area, use the formula for the area of a trapezoid. Substitute 35 for b_1, 20 for b_2, and 12 for h. Solve for A.

Solution
$A = \frac{1}{2}h(b_1 + b_2)$
$A = \frac{1}{2} \cdot 12(35 + 20)$
$A = 330$
The area is 330 cm^2.

78. Strategy To find the area, use the formula for the area of a trapezoid. Substitute 16 for b_1, 18 for b_2, and 5 for h. Solve for A.

Solution
$A = \frac{1}{2}h(b_1 + b_2)$
$A = \frac{1}{2} \cdot 5(16 + 18)$
$A = 85$
The area is 85 in^2.

79. Strategy To find the area, use the formula for the area of a circle. Leave the answer in terms of π. $r = 5$.

Solution
$A = \pi r^2$
$A = \pi(5)^2$
$A = 25\pi$
The area is 25π in^2.

80. Strategy To find the area:
→Find the radius of the circle. $d = 6.5$.
→Use the formula for the area of a circle. Leave the answer in terms of π.

Solution $r = \frac{1}{2}d = \frac{1}{2}(6.5) = 3.25$
$A = \pi r^2$
$A = \pi(3.25)^2$
$A = 10.5625\pi$
The area is 10.5625π m^2.

81. Strategy To find the area:
→Find the radius of the telescope. $d = 200$.
→Use the formula for the area of a circle. Leave the answer in terms of π.

Solution $r = \frac{1}{2}d = \frac{1}{2}(200) = 100$
$A = \pi r^2$
$A = \pi(100)^2$
$A = 10{,}000\pi$
The area is $10{,}000\pi$ in^2.

82. Strategy To find the area, use the formula for the area of a circle. Leave the answer in terms of π. $r = 50$.

Solution $A = \pi r^2$
$A = \pi(50)^2$
$A = 2{,}500\pi$
The area is $2{,}500\pi$ ft^2.

83. Strategy To find the area, use the formula for the area of a rectangle. Substitute 14 for L and 9 for W. Solve for A.

Solution $A = LW$
$A = 14(9)$
$A = 126$
The area of the flower garden is 126 ft^2.

84. Strategy To find the area, use the formula for the area of a square. Substitute 8.5 for s. Solve for A.

Solution $A = s^2$
$A = (8.5)^2$
$A = 72.25$
The area of the patio is 72.25 m^2.

85. Strategy To find the amount of turf, use the formula for the area of a rectangle. Substitute 100 for L and 75 for W. Solve for A.

Solution $A = LW$
$A = 100(75)$
$A = 7{,}500$
7,500 yd^2 of artificial turf must be purchased.

86. Strategy To find the amount of fabric:
→Add 0.2 to the length and width of the fabric.
→Use the formula for the area of a rectangle. Use the measurements of the length and width after adding 0.2.

Solution $L = 5 + 0.2 = 5.2$
$W = 3.5 + 0.2 = 3.7$
$A = LW$
$A = 5.2(3.7)$
$A = 19.24$
19.24 m^2 of fabric must be purchased.

87. Strategy To find the width, use the formula for the area of a rectangle. Substitute 300 for A and 30 for L. Solve for W.

Solution $A = LW$
$300 = 30W$
$10 = W$
The width of the rectangle is 10 in.

88. Strategy To find the length, use the formula for the area of a rectangle. Substitute 312 for A and 12 for W. Solve for L.

Solution $312 = LW$
$312 = L(12)$
$26 = L$
The length of the rectangle is 26 ft.

89. Strategy To find the length of the base, use the formula for the area of a triangle. Substitute 50 for A and 5 for h. Solve for b.

Solution $A = \frac{1}{2}bh$

$50 = \frac{1}{2}b(5)$

$50 = \frac{5}{2}b$

$20 = b$

The base of the triangle is 20 m.

90. Strategy To find the length of the base, use the formula for the area of a parallelogram. Substitute 42 for A and 7 for h. Solve for b.

Solution $A = bh$

$42 = b(7)$

$6 = b$

The base of the parallelogram is 6 m.

91. Strategy To find the number of quarts of stain:

→Use the formula for the area of a rectangle to find the area of the deck.

→Divide the area of the deck by the area one quart will cover (50).

Solution $A = LW$

$A = 10(8)$

$A = 80$

$80 \div 15 = 1.6$

Because a portion of a second quart is needed, 2 qt of stain should be purchased.

92. Strategy To find the number of tiles to be purchased:

→Use the formula for the area of a rectangle to find the area of the kitchen floor.

→Divide the area of the kitchen floor by the area of one tile $\left(1\frac{1}{2}\right)^2$.

Solution $A = LW$

$A = 12(9)$

$A = 108$

$108 \div \left(1\frac{1}{2}\right)^2 = 108 \div \frac{9}{4} = 48$

You should purchase 48 tiles for your kitchen floor.

93. Strategy To find the cost of the wallpaper:

→Use the formula for the area of a rectangle to find the areas of the two walls.

→Add the areas of the two walls.

→Divide the total area by the area in one roll (40) to find the total number of rolls.

→Multiply the number of rolls by 18.50

Solution $A_1 = LW = 9(8) = 72$

$A_2 = LW = 11(8) = 88$

$A = A_1 + A_2 = 72 + 88 = 160$

$160 \div 40 = 4$

$4 \cdot 18.50 = 74$

The cost to wallpaper the two walls is \$74.

94. Strategy To find the amount budgeted:

→Use the formula for the area of a square to find the area of the park.

→Divide the area by 1,200 to find the number of bags of seed.

→Multiply the number of bags of seed by 5.75.

Solution $A = s^2 = 60^2 = 3,600$

$3,600 \div 1,200 = 3$

$5.75 \cdot 3 = 17.25$

\$17.25 should be budgeted for grass seed.

95. Strategy

To find the increase in area:
→Use the formula for the area of a circle to find the area of a circle with $r = 8$.
→Use the formula for the area of a circle to find the area of a circle with radius $r = 8 + 2 = 10$.
→Subtract the area of the smaller circle from the area of the larger circle. An approximation is asked for; use the π key on a calculator.

Solution

$A_1 = \pi r^2$
$A_1 = \pi(8)^2 = 64\pi$
$A_2 = \pi(10)^2 = 100\pi$
$A_2 - A_1 = 100\pi - 64\pi = 36\pi \approx 113.10$
The area is increased by 113.10 in^2.

96. Strategy

To find the increase in area:
→Use the formula for the area of a circle to find the area of a circle with $r = 6$.
→Use the formula for the area of a circle to find the area of a circle with $r = 2(6) = 12$.
→Subtract the area of the smaller circle from the area of the larger circle. An approximation is asked for; use the π key on a calculator.

Solution

$A_1 = \pi r^2$
$A_1 = \pi(6)^2 = 36\pi$
$A_2 = \pi(12)^2 = 144\pi$
$A_2 - A_1 = 144\pi - 36\pi$
$= 108\pi \approx 339.29$
The area is increased by 339.29 cm^2.

97. Strategy

To find the cost of the carpet:
→Use the formula of the area of a rectangle to find the area of the carpet.
→Use the conversion factor $\frac{1 \text{ yd}^2}{9 \text{ ft}^2}$.
→Multiply the area measured in square yards by 15.95.

Solution

$A = LW = 24(15) = 360$
$360 \text{ ft}^2 = 360 \text{ ft}^2 \cdot \frac{1 \text{ yd}^2}{9 \text{ ft}^2}$
$= 40 \text{ yd}^2 = 40(15.95) = 638$
The cost of the carpet is \$638.

98. Strategy

To find the cost of the paint:
→Use the formula for the area of a rectangle to find the area of the two walls that measure 15 by 9 and the two walls that measure 12 by 9.
→Add the area to find the total area.
→Divide the total area by the area that one gallon will cover (400).
→Multiply the number of gallons by 19.98.

Solution

$A_1 = 2(LW) = 2[15(9)] = 270$
$A_1 = 2(LW) = 2[12(9)] = 216$
$A_1 + A_2 = 270 + 216 = 486$
$486 \div 400 = 1.22$
Because the portion of a second gallon is need, 2 gal of paint should be purchased.
$2(19.98) = 39.96$
The paint will cost \$39.96.

99. Strategy

To find the area of the walkway:

→Use the formula for the area of a rectangle to find the area of the plot of grass. Substitute 30 for L and 20 for W.

→Use the formula for a rectangle to find the area of the total area (walkway + grass). Substitute $30+2+2=34$ for L and $20+2+2=24$ for W.

→Subtract the area of the grass from the total area.

Solution

$A_1 = LW = 30(20) = 600$

$A_2 = LW = 34(24) = 816$

$A_2 - A_1 = 816 - 600 = 216$

The area of the walkway is 216 m^2.

100. Strategy

To find the amount of material:

→Use the formula for the area of a rectangle to find the area of the drapes. Substitute $2 \cdot 2 = 4$ for W and $4 + 1 = 5$ for L. ,

→Multiply the area of one drape by 4.

Solution

$A = LW = 5(4) = 20$

$4(20) = 80$

the drapes will required 80 ft^2 of material.

Critical Thinking 9.2, page 542

101. If the ratios of the lengths of the sides of the squares 2: 3, then we can let $s_1 = 2$ and $s_2 = 3$.

$A_1 = s_1^2 = 2^2 = 4$, and $A_2 = s_2^2 = 3^2 = 9$.

The ratio of the areas of the two squares is $4:9$.

102. $A = LW$

Double the length and double the width: $A = (2L)(2W) = 4LW$

$4LW$ is four times the quantity LW.

The area of the resulting rectangle is 4 times larger.

104. $A = \pi r^2, r = \frac{1}{2}d$

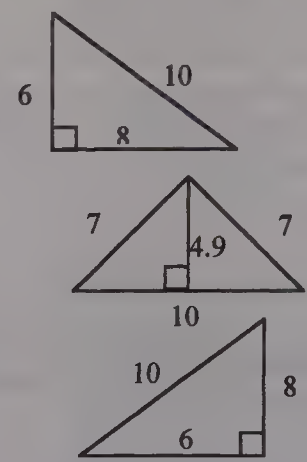
$A = \pi\left(\frac{1}{2}d\right)^2$

$A = \pi\left(\frac{d}{2}\right)^2$

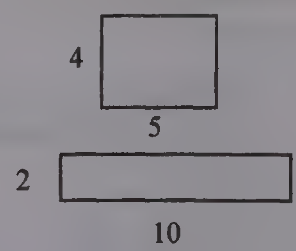
$A = \pi\left(\frac{d^2}{4}\right)$

$A = \frac{\pi d^2}{4}$

105. a. Consider the three triangles shown below. The perimeter of each triangle is 24 units. The area of the first is 24 square units, the area of the second is 24.5 square units, and the area of the third is 24 square units. The statement is sometimes true.



b. Consider the two rectangles shown below. The area of each rectangle is 20 square units. But the perimeter of the first rectangle is 18 units and the perimeter of the second rectangle is 24 units. The statement if sometimes true.



c. Since $A = s^2$, and $\sqrt{s^2} = s$, the length of a side of any square with area s^2 is s. The statement if always true.

d. An isosceles triangle has 2 sides of the same measure and 2 angles of the same measure. An equilateral triangle has 3 equal angles and 3 sides of the same measure. Therefore, 2 angles and 2 sides of an equilateral triangle are of equal measure. The statement is always true.

e. A circle is a plane figure in which all points are the same distance from the center. A radius of a circle is a line segment from the center to a point on the circle. The statement is always true.

f. The distance across a circle through the center of the circle will always be the same distance. The statement is always true.

Section 9.3

Objective A Exercises, page 549

1. Strategy: To find the hypotenuse, use the Pythagorean Theorem. $a = 3, b = 4$

   Solution:
   $c^2 = a^2 + b^2$
   $c^2 = 3^2 + 4^2$
   $c^2 = 9 + 16$
   $c^2 = 25$
   $c = \sqrt{25}$
   $c = 5$
   The length of the hypotenuse is 5 in.

2. Strategy: To find the hypotenuse, use the Pythagorean Theorem. $a = 5, b = 12$

   Solution:
   $c^2 = a^2 + b^2$
   $c^2 = 5^2 + 12^2$
   $c^2 = 25 + 144$
   $c^2 = 169$
   $c = \sqrt{169}$
   $c = 13$
   The length of the hypotenuse is 13 in.

3. Strategy: To find the hypotenuse, use the Pythagorean Theorem. $a = 5, b = 7$

   Solution:
   $c^2 = a^2 + b^2$
   $c^2 = 5^2 + 7^2$
   $c^2 = 25 + 49$
   $c^2 = 74$
   $c = \sqrt{74}$
   $c \approx 8.6$
   The length of the hypotenuse if approximately 8.6 cm.

4. Strategy: To find the hypotenuse, use the Pythagorean Theorem. $a = 7, b = 9$

   Solution:
   $c^2 = a^2 + b^2$
   $c^2 = 7^2 + 9^2$
   $c^2 = 49 + 81$
   $c^2 = 130$
   $c = \sqrt{130}$
   $c \approx 11.4$
   The length of the hypotenuse is approximately 11.4 cm.

5. Strategy: To find the measure of the other leg, use the Pythagorean Theorem. $c = 15, a = 10$

   Solution:
   $a^2 + b^2 = c^2$
   $10^2 + b^2 = 15^2$
   $100 + b^2 = 225$
   $b^2 = 125$
   $b = \sqrt{125}$
   $b \approx 11.2$
   The measure of the other leg is approximately 11.2 ft.

6. Strategy: To find the measure of the other leg, use the Pythagorean Theorem. $c = 20, a = 18$

   Solution:
   $a^2 + b^2 = c^2$
   $18^2 + b^2 = 20^2$
   $324 + b^2 = 400$
   $b^2 = 76$
   $b = \sqrt{76}$
   $b \approx 8.7$
   The measure of the other leg is approximately 8.7 ft.

7. Strategy To find the measure of the other leg, use the Pythagorean Theorem. $c = 6$, $a = 4$

Solution
$$a^2 + b^2 = c^2$$
$$4^2 + b^2 = 6^2$$
$$16 + b^2 = 36$$
$$b^2 = 20$$
$$b = \sqrt{20}$$
$$b \approx 4.5$$
The measure of the other leg is approximately 4.5 cm.

8. Strategy To find the measure of the other leg, use the Pythagorean Theorem. $c = 12$, $a = 9$

Solution
$$a^2 + b^2 = c^2$$
$$9^2 + b^2 = 12^2$$
$$81 + b^2 = 144$$
$$b^2 = 63$$
$$b = \sqrt{63}$$
$$b \approx 7.9$$
The measure of the other leg is approximately 7.9 m.

9. Strategy To find the hypotenuse, use the Pythagorean Theorem. $a = 9$, $b = 9$

Solution
$$c^2 = a^2 + b^2$$
$$c^2 = 9^2 + 9^2$$
$$c^2 = 81 + 81$$
$$c^2 = 162$$
$$c = \sqrt{162}$$
$$c \approx 12.7$$
The length of the hypotenuse is approximately 12.7 yd.

10. Strategy To find the height, use the Pythagorean Theorem to find the other leg. $c = 8$, $a = 3$

Solution
$$a^2 + b^2 = c^2$$
$$3^2 + b^2 = 8^2$$
$$9 + b^2 = 64$$
$$b^2 = 55$$
$$b = \sqrt{55}$$
$$b \approx 7.4$$
The ladder will reach a height of approximately 7.4 m.

11. Strategy To find the distance, use the Pythagorean Theorem to find the hypotenuse of a right triangle. $a = 3$, $b = 8$

Solution
$$c^2 = a^2 + b^2$$
$$c^2 = 3^2 + 8^2$$
$$c^2 = 9 + 64$$
$$c^2 = 73$$
$$c = \sqrt{73}$$
$$c \approx 8.5$$
The distance between the holes is approximately 8.5 cm.

12. Strategy To find the distance from the starting point, use the Pythagorean Theorem to find the hypotenuse of a right triangle. $a = 18$, $b = 12$

Solution
$$c^2 = a^2 + b^2$$
$$c^2 = 18^2 + 12^2$$
$$c^2 = 324 + 144$$
$$c^2 = 468$$
$$c = \sqrt{468}$$
$$c \approx 21.6$$
You are approximately 21.6 mi from the starting point.

13. Strategy To find the perimeter:
→Use the Pythagorean Theorem to find the hypotenuse of the triangle. $a = 5$, $b = 9$
→Use the formula for the perimeter of a triangle to find the perimeter.

Solution
$$c^2 = a^2 + b^2$$
$$c^2 = 5^2 + 9^2$$
$$c^2 = 25 + 81$$
$$c^2 = 106$$
$$c = \sqrt{106}$$
$$c \approx 10.3$$
$$P = a + b + c$$
$$P = 5 + 9 + 10.3$$
$$P = 24.3$$
The perimeter is approximately 24.3 cm.

14. Strategy: To find the perimeter:
→Use the Pythagorean Theorem to find the hypotenuse of the triangle. $a = 6$, $b = 8$
→Use the formula for the perimeter of a triangle to find the perimeter.

Solution:
$c^2 = a^2 + b^2$
$c^2 = 6^2 + 8^2$
$c^2 = 36 + 64$
$c^2 = 100$
$c = \sqrt{100}$
$c = 10$
$P = a + b + c$
$P = 6 + 8 + 10$
$P = 24$
The perimeter is 24 in.

Objective B Exercises, pages 550–551

15. The ratio is $\frac{5}{10} = \frac{1}{2}$.

16. The ratio is $\frac{12}{36} = \frac{1}{3}$.

17. The ratio is $\frac{6}{8} = \frac{3}{4}$.

18. The ratio is $\frac{3}{9} = \frac{1}{3}$.

19. Strategy: To find DE, write a proportion using the fact that in similar triangles, the ratios of corresponding sides are equal. Solve the proportion for DE.

Solution:
$\frac{AB}{DE} = \frac{AC}{DF}$
$\frac{4}{DE} = \frac{5}{9}$
$4(9) = (5)DE$
$36 = (5)DE$
$7.2 = DE$
The length of DE is 7.2 cm.

20. Strategy: To find DE, write a proportion using the fact that in similar triangles, the ratios of corresponding sides are equal. Solve the proportion for DE.

Solution:
$\frac{AB}{DE} = \frac{BC}{EF}$
$\frac{6}{DE} = \frac{7}{16}$
$6(16) = (7)DE$
$96 = (7)DE$
$13.7 \approx DE$
The length of DE is approximately 13.7 in.

21. Strategy: To find the height of triangle DEF, write a proportion using the fact that, in similar triangles, the ratio of corresponding sides equals the ratio of corresponding sides equals the ratio of corresponding heights. Solve the proportion for the height (h).

Solution:
$\frac{AC}{DF} = \frac{2}{h}$
$\frac{3}{5} = \frac{2}{h}$
$3h = 5(2)$
$3h = 10$
$h \approx 3.3$
The height of triangle DEF is approximately 3.3 m.

22. Strategy: To find the height of triangle ABC, write a proportion using the fact that, in similar triangles, the ratio of corresponding sides equals the ratio of corresponding heights. Solve the proportion for the height (h).

Solution:
$\frac{BC}{EF} = \frac{h}{14}$
$\frac{7}{20} = \frac{h}{14}$
$7(14) = 20h$
$98 = 20h$
$4.9 = h$
The height of triangle ABC is 4.9 ft.

23. Strategy To find the perimeter:
→Find the side BC by writing a proportion using the fact that the ratios of corresponding sides of similar triangles are equal.
→Use the formula for the perimeter of a triangle.

Solution
$$\frac{BC}{EF}=\frac{AC}{DF}$$
$$\frac{BC}{6}=\frac{4}{8}$$
$$(8)BC=6(4)$$
$$(8)BC=24$$
$$BC=3$$
$$P=a+b+c$$
$$P=3+4+5$$
$$P=12$$
The perimeter of triangle ABC is 12 m.

24. Strategy To find the perimeter:
→Find the side DF by writing a proportion using the fact that the ratios of corresponding sides of similar triangles are equal.
→Use the formula for the perimeter of a triangle.

Solution
$$\frac{AC}{DF}=\frac{AB}{DE}$$
$$\frac{5}{DF}=\frac{6}{12}$$
$$5(12)=(6)DF$$
$$60=(6)DF$$
$$10=DF$$
$$P=a+b+c$$
$$P=10+12+16$$
$$P=38$$
The perimeter of triangle DEF is 38 cm.

25. Strategy To find the perimeter:
→Find side BC by writing a proportion using the fact that the ratios of corresponding sides of similar triangles are equal.
→Use the formula for the perimeter of a triangle.

Solution
$$\frac{BC}{EF}=\frac{AB}{DE}$$
$$\frac{BC}{15}=\frac{4}{12}$$
$$(12)BC=15(4)$$
$$(12)BC=60$$
$$BC=5$$
$$P=a+b+c$$
$$P=3+4+5$$
The perimeter of the triangle is 12 in.

26. Strategy To find the area:
→Find the height (h) of triangle DEF by writing a proportion using the fact that, in similar triangles, the ratios of corresponding sides equals the ratio of corresponding heights.
→Find the base (DE) by using the fact that the ratios of corresponding sides are equal.
→Use the formula for the area of a triangle.

Solution
$$\frac{AC}{DF}=\frac{2}{h}$$
$$\frac{3}{9}=\frac{2}{h}$$
$$3h=9(2)$$
$$3h=18$$
$$h=6$$
$$\frac{AC}{DF}=\frac{AB}{DE}$$
$$\frac{3}{9}=\frac{5}{DE}$$
$$(3)DE=9(5)$$
$$(3)DE=45$$
$$DE=15$$
$$A=\frac{1}{2}bh$$
$$A=\frac{1}{2}(15)(6)$$
$$A=45$$
The area of the triangle is 45 cm^2.

27. Strategy To find the area:
→Find the height (h) of triangle ABC by writing a proportion using the fact that, in similar triangles, the ratio of corresponding sides equals the ratio of corresponding heights.
→Use the formula for the area of a triangle. $b = 15$

Solution
$$\frac{AB}{DE} = \frac{h}{20}$$
$$\frac{15}{40} = \frac{h}{20}$$
$$15(20) = 40h$$
$$300 = 40h$$
$$7.5 = h$$
$$A = \frac{1}{2}bh$$
$$A = \frac{1}{2}(15)(7.5)$$
$$A \approx 56.3$$
The area of triangle ABC is approximately 56.3 cm^2.

28. Strategy To find the area:
→Find the base (DE) of triangle DEF by writing a proportion using the fact that, in similar triangles, the ratio of corresponding heights equals the ratio of corresponding sides.
→Use the formula for the area of a triangle. $h = 7$

Solution
$$\frac{4}{7} = \frac{AB}{DE}$$
$$\frac{4}{7} = \frac{8}{DE}$$
$$(4)DE = 7(8)$$
$$(4)DE = 56$$
$$DE = 14$$
$$A = \frac{1}{2}bh$$
$$A = \frac{1}{2}(14)(7)$$
$$A = 49$$
The area of triangle DEF is 49 m^2.

29. Strategy To find the height, write a proportion using the fact that, in similar triangles, the ratios of corresponding sides are equal.

Solution
$$\frac{24}{8} = \frac{\text{height}}{6}$$
$$24(6) = 8 \cdot \text{height}$$
$$144 = 8 \cdot \text{height}$$
$$18 = \text{height}$$
The height of the flagpole is 18 ft.

30. Strategy To find the height, write a proportion using the fact that, in similar triangles, the ratios of corresponding sides are equal.

Solution
$$\frac{9}{2} = \frac{\text{height}}{5}$$
$$9(5) = 2 \cdot \text{height}$$
$$45 = 2 \cdot \text{height}$$
$$22.5 = \text{height}$$
The height of the flagpole is 22.5 ft.

31. Strategy To find the height, write a proportion using the fact that, in similar triangles, the ratios of corresponding sides are equal.

Solution
$$\frac{\text{height}}{8} = \frac{8}{4}$$
$$\text{height} \cdot 4 = 8(8)$$
$$4 \cdot \text{height} = 64$$
$$\text{height} = 16$$
The height of the building is 16 m.

32. Strategy To find the height, write a proportion using the fact that, in similar triangles, the ratios of corresponding sides are equal.

Solution
$$\frac{5.2}{\text{height}} = \frac{1.3}{5.2}$$
$$5.2(5.2) = \text{height} \cdot 1.3$$
$$27.04 = 1.3 \cdot \text{height}$$
$$20.8 = \text{height}$$
The height of the building is 20.8 ft.

Objective C Exercises, pages 551–552

33. Strategy To determine if the triangles are congruent, determine if one of the rules for congruence is satisfied.

Solution $AC = DE$, $AB = EF$, and $\angle A = \angle E$.
Two sides and the included angle of one triangle equal two sides and the included angle of the other triangle.
The triangles are congruent by the SAS rule.

34. Strategy To determine if the triangles are congruent, determine if one of the rules for congruence is satisfied.

Solution $AC = DF$, $\angle A = \angle D$, and $\angle C = \angle F$.
Two angles and the included side of one triangle equal two angles and the included side of the other triangle.
The triangles are congruent by the ASA rule.

35. Strategy To determine if the triangles are congruent, determine if one of the rules for congruence is satisfied.

Solution $AB = DE$, $AC = EF$, and $BC = DF$.
Three sides of one triangle equal the three sides of the other triangle. The triangles are congruent by the SSS rule.

36. Strategy To determine if the triangles are congruent, determine if one of the rules for congruence is satisfied.

Solution $AB = EF$, $AC = DE$, and $\angle A = \angle E$.
The two sides and the included angle of one triangle equal two sides and the included angle of the other triangle.
The triangles are congruent by the SAS rule.

37. Strategy To determine if the triangles are congruent, determine if one of the rules for congruence is satisfied.

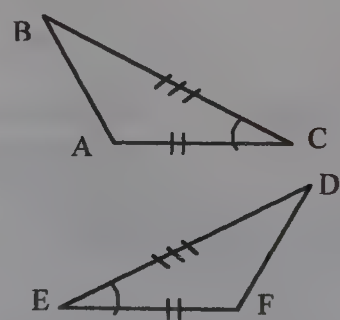
Solution $AC = DF$, $\angle A = \angle D$, and $\angle C = \angle F$.
Two angles and the included side of one triangle equal two angles and the included side of the other triangle.
The triangles are congruent by the ASA rule.

38. Strategy To determine if the triangles are congruent, determine if one of the rules for congruence is satisfied.

Solution $AC = DE$, $BC = EF$, and $AB = DF$.
Three sides of one triangle equal the three sides of the other triangle.
The triangle are congruent by the SSS rule.

39. Strategy Draw a sketch of the two triangles and determine if one of the rules for congruence is satisfied.

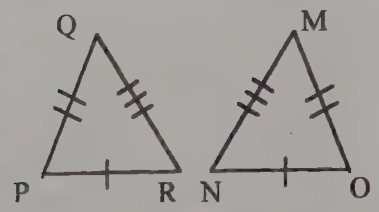
Solution



$AC = EF$, $BC = DE$, and $\angle C = \angle E$.
Because two sides and the included angle of one triangle equal two sides and the included angle of the other triangle, the triangles are congruent by the SAS rule.

40. Strategy Draw a sketch of the two triangles and determine if one of the rules of congruence is satisfied.

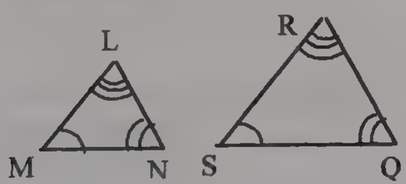
Solution



$PR = NO$, $PQ = MO$, and $QR = MN$.
Because three sides of one triangle equal the three sides of the other triangle, the triangles are congruent by the SSS rule.

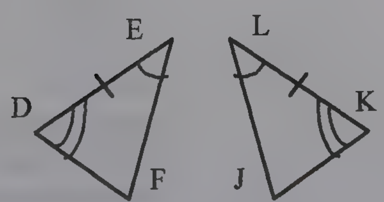
41. Strategy Draw a sketch of the two triangles and determine if one of the rules of congruence is satisfied.

Solution $\angle M = \angle S$, $\angle N = \angle Q$, and



$\angle L = \angle R$.
The triangles do not satisfy the SSS rule, the SAS rule, or the ASA rule. The triangles are not necessarily congruent.

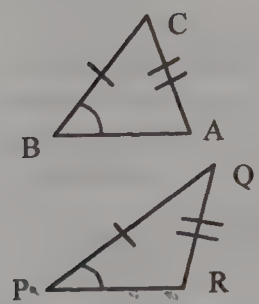
42. Strategy Draw a sketch of the two triangles and determine if one of the rules of congruence is satisfied.



Solution $\angle D = \angle K$, $\angle E = \angle L$, and $DE = KL$.
Because two angles and the included side of one triangle equal two angles and the included side of the other triangle, the triangles are congruent by the ASA rule.

43. Strategy Draw a sketch of the two triangles and determine if one of the rules of congruence is satisfied.

Solution



$\angle B = \angle P$, $BC = PQ$, and $AC = QR$.
The triangles do not satisfy the SSS rule, the SAS rule, or the ASA rule. The triangles are not necessarily congruent.

Critical Thinking 9.3, page 552

44. a. If two angles of one triangle are equal to two angles of a second triangle, then the third angle of the first triangle is equal to the third angle of the second triangle. If three angles of one triangle are equal to the three angles of a second triangle, then the triangles are similar triangles. The statement is always true.

b. An isosceles triangle has two sides of equal length, and the angles opposite the equal sides are of equal measure. But in one isosceles triangle, each of the equal angles could measure 20°, and in another isosceles triangle, each equal angle could measure 60°, in which case the triangles are not similar. The statement is sometimes true.

c. In an equilateral triangle, the three sides are of equal length and the three angles are of equal measure. Given the three angles are of equal measure, each angle of an equilateral triangle must always measure 60°. The statement is always true.

Section 9.4

Objective A Exercise, pages 559–560

1. Strategy: To find the volume, use the formula for the volume of a rectangular solid.
$L = 14$, $W = 10$, $H = 6$.

Solution:
$V = LWH$
$V = 14(10)(6)$
$V = 840$
The volume is 840 in^3.

2. Strategy: To find the volume:
→Find the radius of the cone. $d = 12$.
→Use the formula for the volume of a cone.

Solution:
$r = \frac{1}{2}d = \frac{1}{2}(12) = 6$
$V = \frac{1}{3}\pi r^2 h$
$V = \frac{1}{3}\pi(6)^2(14)$
$V = \frac{1}{3}\pi(36)(14)$
$V = 168\pi$
$V \approx 527.79$
The volume is 168π ft^3.
The volume is approximately 527.59 ft^3.

3. Strategy: To find the volume, use the formula for the volume of a pyramid. $s = 3$, $h = 5$.

Solution:
$V = \frac{1}{3}s^2 h$
$V = \frac{1}{3}(3^2)(5)$
$V = \frac{1}{3}(9)(5)$
$V = 15$
The volume is 15 ft^3.

4. Strategy: To find the volume, use the formula for the volume of a cube. $a = 7.5$.

Solution:
$V = s^3$
$V = (7.5)^3$
$V = 421.875$
The volume is 421.875 m^3.

5. Strategy: To find the volume:
→Find the radius of the sphere. $d = 3$.
→Use the formula for the volume of sphere.

Solution:
$r = \frac{1}{2}d = \frac{1}{2}(3) = 1.5$
$V = \frac{4}{3}\pi r^3$
$V = \frac{4}{3}\pi(1.5)^3$
$V = \frac{4}{3}\pi(3.375)$
$V = 4.5\pi$
$V \approx 14.14$
The volume is 4.5π cm^3.
The volume is approximately 14.14 cm^3.

6. Strategy: To find the volume:
→Find the radius of the cylinder. $d = 8$.
→Use the formula for the volume of a cylinder.

Solution:
$r = \frac{1}{2}d = \frac{1}{2}(8) = 4$
$V = \pi r^2 h$
$V = \pi(4)^2(8)$
$V = \pi(16)(8)$
$V = 128\pi$
$V \approx 402.12$
The volume is 128π cm^3.
The volume is approximately 402.12 cm^3.

7. Strategy: To find the volume, use the formula for the volume of a rectangle solid.
$L = 6.8$, $W = 2.5$, $H = 2$.

Solution:
$V = LWH$
$V = 6.8(2.5)(2)$
$V = 34$
The volume of the rectangular solid is 34 m^3.

8. Strategy: To find the volume, use the formula for the volume of a rectangular solid.
$L = 4.5$, $W = 3$, $H = 1.5$.

Solution $V = LWH$
$V = 4.5(3)(1.5)$
$V = 20.25$
The volume of the rectangular solid is 20.25 ft^3.

9. Strategy To find the volume, use the formula for the volume of a cube. $s = 2.5$.

Solution $V = s^3$
$V = (2.5)^3$
$V = 15.625$
The volume of the cube is 15.625 in^3.

10. Strategy To find the volume, use the formula for the volume of a cube. $s = 7$.

Solution $V = s^3$
$V = 7^3$
$V = 343$
The volume of the cube is 343 cm^3.

11. Strategy To find the volume:
→Find the radius of the sphere. $d = 6$.
→Use the formula for the volume of a sphere.

Solution $r = \frac{1}{2}d = \frac{1}{2}(6) = 3$
$V = \frac{4}{3}\pi r^3$
$V = \frac{4}{3}\pi(3)^3$
$V = \frac{4}{3}\pi(27)$
$V = 36\pi$
The volume of the sphere is $36\pi\text{ ft}^3$.

12. Strategy To find the volume, use the formula for the volume of a sphere. $r = 1.2$.

Solution $V = \frac{4}{3}\pi r^3$
$V = \frac{4}{3}\pi(1.2)^3$
$V = \frac{4}{3}\pi(1.728)$
$V = 2.304\pi$
$V \approx 7.2$
The volume of the sphere is approximately 7.2 m^3.

13. Strategy To find the volume:
→Find the radius of the cylinder. $d = 24$.
→Use the formula for the volume of a cylinder. $h = 18$.

Solution $r = \frac{1}{2}d = \frac{1}{2}(24) = 12$
$V = \pi r^2 h$
$V = \pi(12^2)(18)$
$V = \pi(144)(18)$
$V = 2{,}592\pi$
$V \approx 8{,}143.01$
The volume of the cylinder is approximately $8{,}143.01\text{ cm}^3$.

14. Strategy To find the volume, use the formula for the volume of a cylinder. $r = 4$, $h = 7.2$.

Solution $V = \pi r^2 h$
$V = \pi(4^2)(7.2)$
$V = \pi(16)(7.2)$
$V = 115.2\pi$
The volume of the cylinder is $115.2\pi\text{ m}^3$.

15. Strategy To find the volume, use the formula for the volume of a cone. $r = 5$, $h = 9$.

Solution $V = \frac{1}{3}\pi r^2 h$
$V = \frac{1}{3}\pi(5)^2(9)$
$V = \frac{1}{3}\pi(25)(9)$
$V = 75\pi$
The volume of the cone is $75\pi\text{ in}^3$.

16. Strategy To find the volume:
→Find the radius of the base of the cone. $d = 10$.
→Use the formula for the volume of a cone. $h = 15$.

Solution $r = \frac{1}{2}d = \frac{1}{2}(10) = 5$
$V = \frac{1}{3}\pi r^2 h$
$V = \frac{1}{3}\pi(5)^2(15)$
$V = \frac{1}{3}\pi(25)(15)$
$V = 125\pi$
$V \approx 392.70$
The volume of the cone is approximately 392.70 cm^3.

17. Strategy To find the volume, use the formula for the volume of a pyramid. $s = 6$, $h = 10$.

Solution $V = \frac{1}{3}s^2 h$
$V = \frac{1}{3}(6^2)(10)$
$V = \frac{1}{3}(36)(10)$
$V = 120$
The volume of the pyramid is 120 in^3.

18. Strategy To find the volume, use the formula for the volume of a pyramid. $s = 9$, $h = 8$.

Solution $V = \frac{1}{3}s^2 h$
$V = \frac{1}{3}(9^2)(8)$
$V = \frac{1}{3}(81)(8)$
$V = 216$
The volume of the pyramid is 216 m^3.

19. Strategy To find the width, use the formula for the volume of a rectangular solid. $V = 52.5$, $L = 7$, $H = 3$.

Solution $V = LWH$
$52.5 = 7(W)(3)$
$52.5 = 21W$
$2.5 = W$
The width of the freezer is 2.5 ft.

20. Strategy To find the height, use the formula for the volume of rectangular solid. $V = 1{,}836$, $L = 18$, $W = 12$.

Solution $V = LWH$
$1{,}836 = 18(12)(H)$
$1{,}836 = 216H$
$8.5 = H$
The height of the aquarium is 8.5 in.

21. Strategy To find the radius, use the formula for the volume of a cylinder. $V = 502.4$, $h = 10$.

Solution $V = \pi r^2 h$
$502.4 = \pi r^2(10)$
$50.24 = \pi r^2$
$15.99 \approx r^2$
$\sqrt{15.99} \approx r^2$
→r is the square root of 15.99.
$4.00 \approx r$
The radius of the cylinder is approximately 4.00 in.

22. Strategy To find the height:
→Find the radius of the base of the cylinder. $d = 14$.
→Use the formula for the volume of a cylinder. $V = 2{,}310$.

Solution $r = \frac{1}{2}d = \frac{1}{2}(14) = 7$
$V = \pi r^2 h$
$2{,}310 = \pi(7)^2 h$
$2{,}310 = \pi(49)h$
$15.01 \approx h$
The height of the cone is approximately 15.01 cm.

23. Strategy To find the length and the width, use the formula for the volume of a rectangular solid. $V = 125$, $H = 5$, $L = W$.

Solution $V = LWH$
$125 = LW(5)$
$25 = LW$
$25 = L^2$
Substitute L for W.
$\sqrt{25} = L$
$5 = L$
$5 = W$ because $W = L$.
The length of the rectangular solid is 5 in.
The width of the rectangular solid is 5 in.

24. Strategy To find the length and the width, use the formula for the volume of a rectangular solid.
$V = 864$. $H = 6$, $L = W$.

Solution $V = LWH$
$864 = LW(6)$
$144 = LW$
$144 = L^2$
Substitute L for W.
$\sqrt{144} = L$
$12 = L$
$12 = W$ because $W = L$.
The length of the rectangular solid is 12 m.
The width of the rectangular solid is 12 m.

25. Strategy To find the amount of oil:
→Find the radius of the base of the cylinder. $d = 6$.
→Use the formula for the volume of a cylinder.
$h = 4$.
→Multiply the volume of the cylinder by $\frac{2}{3}$.

Solution $r = \frac{1}{2}d = \frac{1}{2}(6) = 3$
$V = \pi r^2 h$
$V = \pi(3)^2(4)$
$V = \pi(9)(4)$
$V = 36\pi$
$\frac{2}{3}V = \frac{2}{3}(36\pi) = 24\pi \approx 75.40$
The storage tank contains approximately 75.40 m^3 of oil.

26. Strategy To find the amount not being used for storage:
→Find the radius of the base of the cylinder.
$d = 16$.
→Use the formula for the volume of a cylinder.
$h = 30$.
→Multiply the volume of the cylinder by $\frac{1}{4}$, which is the portion not being used.
$\left(1 - \frac{3}{4}\right)$

Solution $r = \frac{1}{2}d = \frac{1}{2}(16) = 8$
$V = \pi r^2 h$
$V = \pi(8)^2(30)$
$V = \pi(64)(30)$
$V = 1{,}920\pi$
$\frac{1}{4}V = \frac{1}{4}(1{,}920\pi)$
$= 480\pi = 1{,}507.96$
The portion of the silo that is not used is approximately 1,507.96 ft^3.

Objective B Exercises, pages 560–562

27. Strategy To find the surface area, use the formula for the surface area of a rectangular solid.
$L = 5$, $W = 4$, $H = 3$.

Solution $SA = 2LW + 2LH + 2WH$
$SA = 2(5)(4) + 2(5)(3)$
$+ 2(4)(3)$
$SA = 40 + 30 + 24$
$SA = 94$
The surface area of the rectangular solid is 94 m^2.

28. Strategy To find the surface area, use the formula for the surface area of a cube. $a = 14$.

Solution $SA = 6s^2$
$SA = 6\left(14^2\right)$
$SA = 6(196)$
$SA = 1{,}176$
The surface area of the cube is 1,176 ft^2.

29. Strategy To find the surface area, use the formula for the surface area of a pyramid. $s = 4$, $l = 5$.

Solution $SA = s^2 + 2sl$
$SA = 4^2 + 2(4)(5)$
$SA = 16 + 40$
$SA = 56$
The surface area of the pyramid is 56 m^2.

30. Strategy To find the surface area:
→Find the radius of the sphere. $d = 2$.
→Use the formula for the surface area of a sphere.

Solution $r = \frac{1}{2}d = \frac{1}{2}(2) = 1$
$SA = 4\pi r^2$
$SA = 4\pi(1)^2$
$SA = 4\pi(1)$
$SA = 4\pi$
$SA \approx 12.57$
The surface area of the sphere is 4π cm^2. The surface area of the sphere is approximately 12.57 cm^2.

31. Strategy To find the surface area, use the formula for the surface area of a cylinder. $r = 6$, $h = 2$.

Solution $SA = 2\pi r^2 + 2\pi rh$
$SA = 2\pi(6^2) + 2\pi(6)(2)$
$SA = 2\pi(36) + 24\pi$
$SA = 72\pi + 24\pi$
$SA = 96\pi$
$SA \approx 301.59$
The surface area of the cylinder is 96π in^2. The surface area of the cylinder is approximately 301.59 in^2.

32. Strategy To find the surface area:
→Find the radius of the cone. $r = 3$.
→Use the formula for the surface area of a cone. $l = 9$.

Solution $r = \frac{1}{2}d = \frac{1}{2}(3) = 1.5$
$SA = \pi r^2 + \pi rl$
$SA = \pi(1.5)^2 + \pi(1.5)(9)$
$SA = \pi(2.25) + 13.5\pi$
$SA = 15.75\pi$
$SA \approx 49.48$
The surface area of the cone is 15.75π ft^2. The surface area of the cone is approximately 49.48 ft^2.

33. Strategy To find the surface area, use the formula for the surface area of a rectangular solid. $H = 5$, $L = 8$, $W = 4$.

Solution $SA = 2LW + 2LH + 2WH$
$SA = 2(8)(4) + 2(8)(5) + 2(4)(5)$
$SA = 64 + 80 + 40$
$SA = 184$
The surface area of the rectangular solid is 184 ft^2.

34. Strategy To find the surface area, use the formula for the surface area of a rectangular solid. $L = 60$, $W = 32$, $H = 14$.

Solution $SA = 2LW + 2LH + 2WH$
$SA = 2(60)(32) + 2(60)(14) + 2(32)(14)$
$SA = 3{,}840 + 1{,}680 + 896$
$SA = 6{,}416$
The surface area of the rectangular solid is 6,416 cm^2.

35. Strategy To find the surface area, use the formula for the surface area of a cube. $s = 3.4$.

Solution $SA = 6s^2$
$SA = 6(3.4)^2$
$SA = 6(11.56)$
The surface area of the cube is 69.36 m^2.

36. Strategy To find the surface area, use the formula for the surface area of a cube. $s = 1.5$.

Solution $SA = 6s^2$

$SA = 6(1.5)^2$

$SA = 6(2.25)$

The surface area of the cube is 13.5 in^2.

37. Strategy To find the surface area:

→Find the radius of the sphere. $d = 15$.

→Use the formula for the surface area of a sphere.

Solution $r = \frac{1}{2}d = \frac{1}{2}(15) = 7.5$

$SA = 4\pi r^2$

$SA = 4\pi(7.5)^2$

$SA = 4\pi(56.25)$

$SA = 225\pi$

The surface area of the sphere is $225\pi\text{ cm}^2$.

38. Strategy To find the surface area, use the formula for the surface area of a sphere. $r = 2$.

Solution $SA = 4\pi r^2$

$SA = 4\pi(2^2)$

$SA = 4\pi(4)$

$SA = 16\pi$

$SA \approx 50.27$

The surface area of the sphere is approximately 50.27 in^2.

39. Strategy To find the surface area, use the formula for the surface area of a cylinder. $r = 4$, $h = 12$.

Solution $SA = 2\pi r^2 + 2\pi rh$

$SA = 2\pi(4^2) + 2\pi(4)(12)$

$SA = 2\pi(16) + 96\pi$

$SA = 32\pi + 96\pi$

$SA = 128\pi$

$SA \approx 402.12$

The surface area of the cylinder is approximately 402.12 in^2.

40. Strategy To find the surface area:

→Find the radius of the base of the cylinder. $d = 1.8$.

→Use the formula for the surface area of a cylinder. $h = 0.7$.

Solution $r = \frac{1}{2}d = \frac{1}{2}(1.8) = 0.9$

$SA = 2\pi r^2 + 2\pi rh$

$SA = 2\pi(0.9^2) + 2\pi(0.9)(0.7)$

$SA = 2\pi(0.81) + 1.26\pi$

$SA = 1.62\pi + 1.26\pi$

$SA = 2.88\pi$

The surface area of the cylinder is $2.88\pi\text{ m}^2$.

41. Strategy To find the surface area, use the formula for the surface area of a cone. $r = 1.5$, $l = 2.5$.

Solution $SA = \pi r^2 + \pi rl$

$SA = \pi(1.5^2) + \pi(1.5)(2.5)$

$SA = \pi(2.25) + 3.75\pi$

$SA = 6\pi$

The surface area of the cone is $6\pi\text{ ft}^2$.

42. Strategy To find the surface area:

→Find the radius of the base of the cone. $d = 21$.

→Use the formula for the surface area of a cone. $l = 16$.

Solution $r = \frac{1}{2}d = \frac{1}{2}(21) = 10.5$

$SA = \pi r^2 + \pi rl$

$SA = \pi(10.5)^2 + \pi(10.5)(16)$

$SA = \pi(110.25) + 168\pi$

$SA = 278.25\pi$

$SA \approx 874.15$

The surface area of the cone is approximately 874.15 in^2.

43. Strategy To find the surface area, use the formula for the surface area of a pyramid. $s = 9$, $l = 12$.

Solution $SA = s^2 + 2sl$
$SA = 9^2 + 2(9)(12)$
$SA = 81 + 216$
$SA = 297$
The surface area of the pyramid is 297 in^2.

44. Strategy To find the surface area, use the formula for the surface area of a pyramid. $s = 16$, $l = 18$.

Solution $SA = s^2 + 2sl$
$SA = 16^2 + 2(16)(18)$
$SA = 256 + 576$
$SA = 832$
The surface area of the pyramid is 832 m^2.

45. Strategy To find the width, use the formula for the surface area of a rectangular solid.
$SA = 108$, $L = 6$, and $H = 4$.

Solution $SA = 2LW + 2LH + 2WH$
$108 = 2(6)W + 2(6)(4)$
$+ 2W(4)$
$108 = 12W + 48 + 8W$
$108 = 20W + 48$
$60 = 20W$
$3 = W$
The width of the rectangular solid is 3 cm.

46. Strategy To find the height, use the formula for the surface area of a rectangular solid.
$SA = 162$, $L = 12$, $W = 3$.

Solution $SA = 2LW + 2LH + 2WH$
$162 = 2(12)3 + 2(12)H$
$+ 2(3)H$
$162 = 72 + 24H + 6H$
$162 = 72 + 30H$
$90 = 30H$
$3 = H$
The width of the rectangular solid is 3 ft.

47. Strategy To find the number of cans or paint:
→Find the formula for the surface area of a cylinder. $r = 12$, $h = 30$.
→Divide the surface area by 300.

Solution $SA = 2\pi r^2 + 2\pi rh$
$SA = 2\pi(12^2) + 2\pi(12)(30)$
$SA = 2\pi(144) + 720\pi$
$SA = 288\pi + 720\pi$
$SA = 1{,}008\pi$
$1{,}008\pi \div 300 \approx 10.56$
Because a portion of an eleventh can is needed, 11 cans of paint should be purchased.

48. Strategy To find the amount of fabric:
→Find the radius of the sphere. $d = 32$.
→Use the formula for the surface area of a sphere.

Solution $r = \frac{1}{2}d = \frac{1}{2}(32) = 16$
$SA = 4\pi r^2$
$SA = 4\pi(16^2)$
$SA = 4\pi(256)$
$SA = 1024\pi$
$SA \approx 3{,}217$
Approximately 3,217 ft^2 of fabric was used to construct the balloon.

49. Strategy To find the amount of glass, use the formula for the surface area of a rectangular solid. Omit the top of the fish tank. The formula becomes
$SA = LW + 2LH + 2WH$.
$L = 12$, $W = 8$, $H = 9$.

Solution $SA = LW + 2LH + 2WH$
$SA = 12(8) + 2(12)(9)$
$+ 2(8)(9)$
$SA = 96 + 216 + 144$
$SA = 456$
The fish tank requires 456 in^2 of glass.

50. Strategy To find the area of the label:
→Find the radius of the base of the cylinder. $d = 16.5$.
→Use the fact that the surface area of the side of a cylinder is given by $2\pi rh$. $h = 17$.

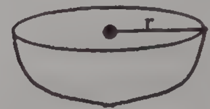
Solution $r = \frac{1}{2}d = \frac{1}{2}(16.5) = 8.25$
Area of the label $= 2\pi rh$
Area of the label $= 2\pi(8.25)(17)$
Area of the label ≈ 881.22
The area of the label is approximately $881.22\ \text{cm}^2$.

51. Strategy To find the difference in area:
→Use the formula for the surface area of a pyramid. $s = 5, l = 8$.
→Use the formula for the surface area of a cone. $r = \frac{1}{2}d = \frac{1}{2}(5) = 2.5$, $l = 8$.
→Subtract the surface area of the cone from the surface area of the pyramid.

Solution We first calculate the area of the pyramid.
$SA = s^2 + 2sl$
$SA = 5^2 + 2(5)(8)$
$SA = 25 + 80$
$SA = 105$
We now calculate the surface area of the cone.
$SA = \pi r^2 + \pi rl$
$SA = \pi(2.5)^2 + \pi(2.5)(8)$
$SA = \pi(6.25) + 20\pi$
$SA = 26.25\pi$
$SA \approx 82.47$
$105 - 82.47 = 22.53$
The surface area of the pyramid is approximately $22.53\ \text{cm}^2$ larger than the surface area of the cone.

Critical Thinking 9.4, page 562

52. The volume of the sphere is $V = \frac{4}{3}\pi r^3$.
The volume of a hemisphere is
$V = \frac{1}{2}\left(\frac{4}{3}\pi r^3\right) = \frac{2}{3}\pi r^3$.
The surface area of a sphere is $SA = 4\pi r^2$.
The surface area of a hemisphere is
$SA = \frac{1}{2}\left(4\pi r^2\right) + \pi r^2$
$= 2\pi r^2 + \pi r^2 = 3\pi r^2$.



hemisphere

53. a. The distance from the edge of the base to the vertex of a regular pyramid is longer than the distance, perpendicular to the base, from the base to the vertex. The statement is always true.

b. The distance from the edge of the base of a cone to the vertex is longer than the distance, perpendicular to the base, from the base to the vertex. The statement is never true.

c. The four triangular faces of a regular pyramid could be equilateral triangles, but they could be isosceles triangles that are not equilateral. The statement is sometimes true.

54. a. The surface area of a rectangular solid is $SA = 2LW + 2LH + 2WH$.
Double the width and height:
$SA = 2L(2W) + 2L(2H) + 2(2W)(2H)$
$SA = 4LW + 4LH + 8WH$
$SA = 2(2LW + 2LH + 2WH) + 4WH$
The surface area is twice the original surface area plus $4WH$.

b. The volume of a rectangular solid is $V = LWH$.
Double the length and width:
$V = (2L)(2W)H$
$V = 4LWH$
The quantity $4LWH$ is 4 times LWH.
The volume is quadrupled.

c. The volume of a cube is $V = s^3$.
Double the length of a side:
$V = (2s)^3$
$V = 8s^3$
The volume is 8 times the original volume.

d. The surface area of a cylinder:
$SA = 2\pi r^2 + 2\pi rh$
Double the radius and double the height:
$SA = 2\pi(2r)^2 + 2\pi(2r)(2h)$
$SA = 2\pi(4r^2) + 8\pi rh$
$SA = 8\pi r^2 + 8\pi rh$
$SA = 4(2\pi r^2 + 2\pi rh)$
The surface area is 4 times the original surface area.

Section 9.5

Objective A Exercises, pages 567–568

1. Strategy: To find the perimeter, add the lengths of the sides.

Solution: $P = 19 + 20 + 8 + 5 + 27 + 42$
$P = 121$
The perimeter of the polygon is 121 cm.

2. Strategy: To find the perimeter, add the lengths of the sides.

Solution: $P = 34.97 + 22.75 + 25.73 + 15.94 + 18.30 + 21.61$
$P = 139.3$
The perimeter of the polygon is 139.3 m.

3. Strategy: The perimeter is the sum of the two diameters plus two half-circles.

Solution: $P = d + d + 2\left(\frac{1}{2}\pi d\right)$
$P = 2 + 2 + \pi(2)$
$P = 4 + 2\pi$
$P \approx 10.28$
The perimeter is $(4 + 2\pi)$ ft.
The perimeter is approximately 10.28 ft.

4. Strategy: The perimeter is the sum of four half-circles.

Solution: $P = 4\left(\frac{1}{2}\pi d\right)$
$P = 2\pi(4)$
$P = 8\pi$
$P \approx 25.13$
The perimeter is 8π cm.
The perimeter is approximately 25.13 cm.

5. Strategy: The perimeter is the sum of three sides of a rectangle and $\frac{1}{2}$ the circumference of a circle.

Solution: $P = 2L + W + \frac{1}{2}(\pi d)$
$P = 2(15) + 8 + \frac{1}{2}\pi(8)$
$P = 38 + 4\pi$
$P \approx 50.57$
The perimeter is $(38 + 4\pi)$ m.
The perimeter is approximately 50.57 m.

6. Strategy: The perimeter is the sum of two radii and $\frac{3}{4}$ the circumference of a circle.

Solution: $P = r + r + \frac{3}{4}(2\pi r)$
$P = 6 + 6 + \frac{3}{2}\pi(6)$
$P = 12 + 9\pi$
$P \approx 40.27$
The perimeter is $(12 + 9\pi)$ cm.
The perimeter is approximately 40.27 cm.

7. Strategy: The perimeter is the sum of the measure of the sides of the figure. (Hint: Find the lengths of the two unlabeled sides first.)

Solution: $60 - 42 = 18$; $28 - 12 = 16$
$P = 28 + 60 + 12 + 42 + 16 + 18$
$P = 176$
The perimeter is 176 ft.

8. Strategy: The perimeter is the sum of two sides of a rectangle plus two half circles.

Solution $P = 2L + 2\left(\frac{1}{2}\pi d\right)$

$P = 2(8) + \pi(3)$

$P = 16 + 3\pi$

$P \approx 25.42$

The perimeter is $(16 + 3\pi)$ in.

The perimeter is approximately 25.42 in.

9. Strategy The perimeter is the sum of two sides of a triangle plus one-half the circumference of a circle.

Solution $P = 2 + 2 + \frac{1}{2}(\pi d)$

$P = 4 + \frac{1}{2}\pi(2)$

$P = 4 + \pi$

$P \approx 7.14$

The perimeter is $(4 + \pi)$ ft.

The perimeter is approximately 7.14 ft.

10. Strategy The perimeter is the sum of the four sides plus one-half the circumference of a circle.

Solution $P = 5 + 5 + 5 + 5 + \frac{1}{2}\pi d$

$P = 20 + \frac{1}{2}\pi(7)$

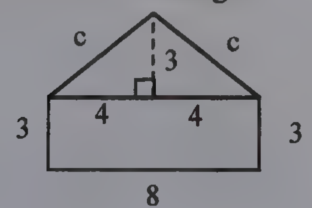
$P = 20 + 3.5\pi$

$P = 31.00$

The perimeter is $(20 + 3.5\pi)$ cm.

The perimeter is approximately 31.00 cm.

11. Strategy The perimeter is the sum of three sides of a rectangle and two sides of a triangle. Use the Pythagorean Theorem to find the side of the triangle.



Solution $c^2 = a^2 + b^2$

$c^2 = 4^2 + 3^2$

$c^2 = 16 + 9$

$c^2 = 25$

$c = \sqrt{25} = 5$

$P = L + 2W + 2c$

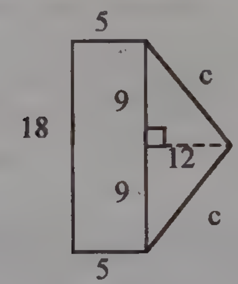
$P = 8 + 2(3) + 2(5)$

$P = 8 + 6 + 10$

$P = 24$

The perimeter is 24 m.

12. Strategy The perimeter is the sum of three sides of a rectangle and two sides of a triangle. Use the Pythagorean Theorem to find the side of the triangle.



Solution $c^2 = a^2 + b^2$

$c^2 = 9^2 + 12^2$

$c^2 = 81 + 144$

$c^2 = 225$

$c = \sqrt{225} = 15$

$P = L + 2W + 2c$

$P = 18 + 2(5) + 2(15)$

$P = 18 + 10 + 30$

$P = 58$

The perimeter is 58 cm.

13. Strategy The perimeter is equal to three sides of a rectangle plus one half the circumference of a circle.

Solution $P = 2L + W + \frac{1}{2}\pi d$

$P = 2(6.5) + 3 + \frac{1}{2}\pi(3)$

$P = 16 + 1.5\pi$

$P \approx 20.71$

Approximately 20.71 ft of weather stripping was used around the door.

14. Strategy The perimeter is equal to two sides of a rectangle plus two half circles.

Solution $P = 2L + 2\left(\frac{1}{2}\pi d\right)$

$P = 2(25) + \pi(10)$

$P = 50 + 10\pi$

$P \approx 81.42$

The perimeter of the roller rink is approximately 81.42 m.

15. Strategy To find the cost:

→Find the length of fencing not along the road.

→Multiply the cost per foot times the length for each type of fence and add.

Solution Length = 2(800) + 1,250 = 2,850

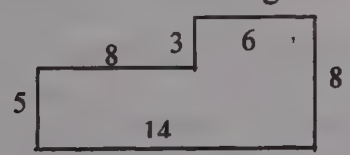
Cost = 5.10(2,850) + 6.70(1,250)

Cost = 22,910

The cost of the fence is $22,910.

16. Strategy To find the cost:

→Use the diagram to find the perimeter of the rain gutter.



→Multiply the length times the cost per foot.

Solution $L = 14 + 8 + 6 + 3 + 8 + 5$

$L = 44$

Cost = 44(22.60)

Cost = 994.40

The cost of the rain gutter is $994.40.

Objective B Exercises, pages 568–569

17. Strategy The area is equal to the area of the rectangle minus the area of the triangle. The base of the triangle is 8 – (2 + 2) = 4.

Solution $A = LW - \frac{1}{2}bh$

$A = 8(4) - \frac{1}{2}(4)(3)$

$A = 32 - 6$

$A = 26$

The area is 26 cm^2.

18. Strategy The area is equal to the area of the rectangle minus the area of the triangle.

Solution $A = LW - \frac{1}{2}bh$

$A = 80(30) - \frac{1}{2}(30)(12)$

$A = 2{,}400 - 180$

$A = 2{,}220$

The area is 2,220 cm^2.

19. Strategy The area is equal to the area of a square plus $\frac{1}{2}$ the area of a circle. The radius of the circle is one half the length of a side of the square (6).

Solution $r = \frac{1}{2}s = \frac{1}{2}(6) = 3$

$A = s^2 + \frac{1}{2}\pi r^2$

$A = 6^2 + \frac{1}{2}\pi(3)^2$

$A = 36 + \frac{1}{2}\pi(9)$

$A = 36 + 4.5\pi$

$A \approx 50.14$

The area is $(36 + 4.5\pi)$ in^2. The area is approximately 50.14 in^2.

20. Strategy The area is equal to the area of a rectangle minus $\frac{1}{2}$ the area of a circle. The radius of the circle is one half the length of the width of the rectangle (0.8).

Solution $r = \frac{1}{2}W = \frac{1}{2}(0.8) = 0.4$

$A = LW - \frac{1}{2}\pi r^2$

$A = 2(0.8) - \frac{1}{2}\pi(0.4)^2$

$A = 1.6 - \frac{1}{2}\pi(0.16)$

$A = 1.6 - 0.08\pi$

$A \approx 1.35$

The area is $(1.6 - 0.08\pi)$ m^2. The area is approximately 1.35 m^2.

21. Strategy The area is equal to $\frac{3}{4}$ of the area of a circle.

Solution
$$A=\frac{3}{4}\pi r^2$$
$$A=\frac{3}{4}\pi\left(8^2\right)$$
$$A=\frac{3}{4}\pi(64)$$
$$A=48\pi$$
$$A\approx 150.80$$
The area is 48π in^2.
The area is approximately 150.80 in^2.

22. Strategy The area is equal to the area of a rectangle minus $\frac{1}{2}$ the area of a circle. The radius of the circle is one half the length of the rectangle.

Solution
$$r=\frac{1}{2}L=\frac{1}{2}(4)=2$$
$$A=LW-\frac{1}{2}\pi r^2$$
$$A=4\left(3\frac{1}{2}\right)-\frac{1}{2}\pi(2)^2$$
$$A=14-\frac{1}{2}\pi(4)$$
$$A=14-2\pi$$
$$A\approx 7.72$$
The area is $(14-2\pi)$ ft^2.
The area is approximately 7.72 ft^2.

23. Strategy The area is equal to the area of the rectangle plus the area of the triangle.

Solution
$$h=9-6=3$$
$$b=W=4$$
$$A=LW+\frac{1}{2}bh$$
$$A=6(4)+\frac{1}{2}(4)(3)$$
$$A=24+6=30$$
The area is 30 in^2.

24. Strategy To find the area, use the formula for the area of a trapezoid.

Solution
$$A=\frac{1}{2}h(b_1+b_2)$$
$$A=\frac{1}{2}\cdot 4(12+8)$$
$$A=2(20)=40$$
The area is 40 m^2.

25. Strategy The area is equal to the area of a rectangle plus the area of a triangle.

Solution
$$h=5-3=2$$
$$b=4$$
$$A=LW+\frac{1}{2}bh$$
$$A=4(3)+\frac{1}{2}(4)(2)$$
$$A=12+4$$
$$A=16$$
The area is 16 in^2.

26. Strategy The area is equal to the area of a triangle plus $\frac{1}{2}$ the area of a circle. The radius is $\frac{1}{2}$ the diameter.

Solution
$$r=\frac{1}{2}d=\frac{1}{2}(22)=11$$
$$A=\frac{1}{2}bh+\frac{1}{2}\pi r^2$$
$$A=\frac{1}{2}(22)(22)+\frac{1}{2}\pi(11)^2$$
$$A=242+\frac{1}{2}\pi(121)$$
$$A=242+60.5\pi$$
$$A\approx 432.07$$
The area is $(242+60.5\pi)$ cm^2.
The area is approximately 432.07 cm^2.

27. Strategy The area is equal to the area of a triangle plus the area of $\frac{1}{2}$ the area of a circle. The radius of the circle is $\frac{1}{2}$ the diameter.

Solution
$$r=\frac{1}{2}d=\frac{1}{2}(10)=5$$
$$A=\frac{1}{2}bh+\frac{1}{2}\left(\pi r^2\right)$$
$$A=\frac{1}{2}(10)(8)+\frac{1}{2}\pi(5)^2$$
$$A=40+\frac{1}{2}\pi(25)$$
$$A=40+12.5\pi$$
$$A\approx 79.27$$
The area is $(40+12.5\pi)$ in^2.
The area is approximately 79.27 in^2.

28. Strategy To find the area, use the formula for the area of a trapezoid.

Solution $A = \frac{1}{2}h(b_1 + b_2)$
$A = \frac{1}{2} \cdot 6(21+5)$
$A = 3(26) = 78$
The area is 78 m^2.

29. Strategy To find the cost:
→Find the area of the room and hallway. The total area is the area of two rectangles.
→Multiply the total area by 28.50.

Solution $A = L_1W_1 + L_2W_2$
$A = 6.8(4.5) + (10.8 - 6.8)(1)$
$A = 30.6 + 4(1)$
$A = 34.6$
Cost = (34.6)(28.50) = 986.10
The cost of the carpet is $986.10.

30. Strategy To find the area of the boundary:
→Find the area of the total area of the boundary and the swimming pool.
→Subtract the area of the swimming pool from the total area.

Solution $L_1 = 8 + 2(2) = 12$
$W_1 = 5 + 2(2) = 9$
$A = L_1W_1 - L_2W_2$
$A = 12(9) - 8(5)$
$A = 108 - 40 = 68$
The area of the boundary is 68 m^2.

31. Strategy To find the amount of hardwood, find the area of the rectangle plus the area of two half circles. The radius of the circle is one half the width of the rectangle.

Solution $r = \frac{1}{2}W = \frac{1}{2}(80) = 40$
$A = LW + 2\left(\frac{1}{2}\pi r^2\right)$
$A = 175(80) + \pi\left(40^2\right)$
$A = 14{,}000 + 1{,}600\pi$
$A \approx 19{,}026.55$
19,026.55 ft^2 of hardwood floor is needed to cover the floor.

32. Strategy The area of the park is the area of the large rectangle minus the area of the small rectangle plus $\frac{1}{2}$ the area of the circle. The radius of the circle is one half the diameter.

Solution $r = \frac{1}{2}d = \frac{1}{2}(2.5 + 4.3) = \frac{1}{2}(6.8) = 3.4$
$A = L_1W_1 - L_2W_2 + \frac{1}{2}\pi r^2$
$A = 17.5(4.3 + 2.5) - (17.5 - 12.7)(2.5) + \frac{1}{2}\pi(3.4)^2$
$A = 17.5(6.8) - 4.8(2.5) + \frac{1}{2}(\pi)(11.56)$
$A \approx 119 - 12 + 18.16$
$A \approx 125.16$
The total area of the national park is 125.16 mi^2.

Objective C Exercises, pages 569–571

33. Strategy
The volume is equal to the volume of the rectangular solid minus the volume of the cylinder. The radius of the cylinder is one half the diameter of the circle.

Solution
$$r=\frac{1}{2}d=\frac{1}{2}(0.4)=0.2$$
$$V=LWH-\pi r^2h$$
$$V=2(1.2)(0.8)-\pi(0.2)^2(2)$$
$$V=1.92-\pi(0.04)2$$
$$V=1.92-0.08\pi$$
$$V\approx 1.67$$
The volume of the solid is $(1.92 - 0.08\pi)$ m^3. The volume of the solid is approximately 1.67 m^3.

34. Strategy
The volume if equal to the sum of the volumes of the two rectangular solids. The width of the smaller rectangular solid is
$2-1.5=0.5$.

Solution
$$V=L_1W_1H_1+L_2W_2H_2$$
$$V=2(1.5)(1.5)+2(0.5)(0.5)$$
$$V=4.5+0.5$$
$$V=5$$
The volume of the solid is 5 m^3.

35. Strategy
The volume is equal to the volume of a cylinder plus one half the volume of a sphere. The radius of the sphere is one half the diameter of the cylinder.

Solution
$$r=\frac{1}{2}d=\frac{1}{2}d(6)=3$$
$$V=\pi r^2h+\frac{1}{2}\left(\frac{4}{3}\pi r^3\right)$$
$$V=\pi\left(3^2\right)(12)+\frac{2}{3}\pi\left(3^3\right)$$
$$V=\pi(9)(12)+\frac{2}{3}\pi(27)$$
$$V=108\pi+18\pi=126\pi$$
$$V\approx 395.84$$
The volume of the solid is 126π ft^3. The volume of the solid is approximately 395.84 ft^3.

36. Strategy
The volume is equal to the volume of the rectangular solid minus one half the volume of the cylinder. The radius of the cylinder is one half the diameter of the circle.

Solution
$$r=\frac{1}{2}d=\frac{1}{2}(2)=1$$
$$V=LWH-\frac{1}{2}\pi r^2h$$
$$V=8(4)(4)-\frac{1}{2}\pi\left(1^2\right)(8)$$
$$V=128-\frac{1}{2}\pi(1)(8)$$
$$V=128-4\pi$$
$$V\approx 115.43$$
The volume of the solid is $(128-4\pi)$ cm^3.
The volume of the solid is approximately 115.43 cm^3.

37. Strategy
The volume is equal to the volume of the larger rectangular solid minus the volume of the smaller rectangular solid.

Solution
$$V=L_1W_1H_1-L_2W_2H_2$$
$$V=8(5)(8)-8(3)(2)$$
$$V=320-48$$
$$V=272$$
The volume of the solid is 272 ft^3.

38. Strategy
The volume of the solid is the volume of the rectangular solid plus one half the volume of a cylinder. The radius of the cylinder is one half the width of the rectangular solid.

Solution
$$r=\frac{1}{2}W=\frac{1}{2}(6)=3$$
$$V=LWH+\frac{1}{2}\left(\pi r^2h\right)$$
$$V=9(6)(1)+\frac{1}{2}\pi\left(3^2\right)(2)$$
$$V=54+\frac{1}{2}\pi(9)(2)$$
$$V=54+9\pi$$
$$V\approx 82.27$$
The volume of the solid is $(54+9\pi)$ in^3. The volume of the solid is approximately 82.27 in^3.

39. Strategy The volume is equal to the volume of the cylinder plus the volume of the cone. The radius of the cone is equal to one half the diameter of the cylinder.
$h_1 = 3, h_2 = 2$

Solution
$r = \frac{1}{2}d = \frac{1}{2}(3) = 1.5$
$V = \pi r^2 h_1 + \frac{1}{3}\pi r^2 h_2$
$V = \pi(1.5)^2(3) + \frac{1}{3}\pi(1.5)^2(2)$
$V = \pi(2.25)(3) + \frac{1}{3}\pi(2.25)(2)$
$V = 6.75\pi + 1.5\pi = 8.25\pi$
$V \approx 25.92$
The volume of the solid is 8.25π in^3.
The volume of the solid is approximately 25.92 in^3.

40. Strategy The volume is equal to the volume of the cylinder plus the volume of the rectangular solid.

Solution
$V = \pi r^2 h + LWH$
$V = \pi(8^2)(2) + 4(4)(15)$
$V = \pi(64)(2) + 240$
$V = 128\pi + 240$
$V \approx 642.12$
The volume of the solid is $(128\pi + 240)$ m^3.
The volume of the solid is approximately 642.12 m^3.

41. Strategy The volume is equal to the volume of a cone plus one half the volume of a sphere. The radius of the sphere is one half the diameter of the cone.

Solution
$r = \frac{1}{2}d = \frac{1}{2}(6) = 3$
$V = \frac{1}{3}\pi r^2 h + \frac{1}{2}\left(\frac{4}{3}\pi r^3\right)$
$V = \frac{1}{3}\pi(3)^2(6) + \frac{2}{3}\pi\left(3^3\right)$
$V = \frac{1}{3}\pi(9)(6) + \frac{2}{3}\pi(27)$
$V = 18\pi + 18\pi = 36\pi$
$V \approx 113.10$
The volume of the solid is 36π in^3.
The volume of the solid is approximately 113.10 in^3.

42. Strategy The volume is equal to the volume of the large cylinder plus of the volume of the small cylinder. The radius of each cylinder is one half the diameter of each cylinder.

Solution
$r_1 = \frac{1}{2}d_1 = \frac{1}{2}(6) = 3$
$r_2 = \frac{1}{2}d_2 = \frac{1}{2}(2) = 1$
$V = \pi r_1^2 h + \pi r_2^2 h$
$V = \pi\left(3^2\right)(2) + \pi\left(1^2\right)(4)$
$V = \pi(9)(2) + \pi(1)(4)$
$V = 18\pi + 4\pi = 22\pi$
$V \approx 69.12$
The volume of the solid is 22π in^3.
The volume of the solid is approximately 69.12 in^3.

43. Strategy The volume is equal to the large cylinder minus the small cylinder. The radius of each cylinder is one half the diameter of each cylinder.

Solution
$r_1 = \frac{1}{2}d_1 = \frac{1}{2}(18) = 9$
$r_2 = \frac{1}{2}d_2 = \frac{1}{2}(9) = 4.5$
$V = \pi r_1^2 h - \pi r_2^2 h$
$V = \pi(9^2)(24) - \pi(4.5)^2(24)$
$V = \pi(81)(24) - \pi(20.25)(24)$
$V = 1{,}944\pi - 486\pi\ 1{,}458\pi$
$V \approx 4{,}580.44$
The volume of the solid is 1,458 cm^3.
The volume of the solid is approximately 4,580.44 cm^3.

44. Strategy The volume is equal to the volume of a rectangular solid plus the volume of a pyramid. The height of the pyramid is $5 - 2 = 3$.

Solution
$V = LWH + \frac{1}{3}s^2 h$
$V = 8(8)(2) + \frac{1}{3}\left(8^2\right)(3)$
$V = 128 + \frac{1}{3}(64)(3)$
$V = 128 + 64 = 192$
The volume of the solid is 192 in^3.

45\. Strategy The volume of the bushing is equal to the volume of the rectangular solid minus one half the volume of the cylinder. The radius of the cylinder is one half the diameter of the cylinder.

Solution $r = \frac{1}{2}d = \frac{1}{2}(4) = 2$

$V = LWH - \frac{1}{2}\pi r^2 h$

$V = 12(8)(3) - \frac{1}{2}\pi(2^2)(12)$

$V = 288 - \frac{1}{2}\pi(4)(12)$

$V = 288 - 24\pi$

$V \approx 212.60$

The volume of the solid is approximately 212.60 in^3.

46\. Strategy The amount of oil is equal to one half the volume of the tank. The volume of the tank is equal to the volume of the cylinder plus the sum of two half spheres. The radius of the sphere is one half the diameter of the cylinder.

Solution $r = \frac{1}{2}d = \frac{1}{2}(8) = 4$

$V = \pi r^2 h + 2\left[\frac{1}{2}\left(\frac{4}{3}\pi r^3\right)\right]$

$V = \pi(4^2)(30) + \frac{4}{3}\pi(4^3)$

$V = \pi(16)(30) + \frac{4}{3}\pi(64)$

$V = 480\pi + \frac{256}{3}\pi$

$\frac{1}{2}V = \frac{1}{2}\left(480\pi + \frac{256}{3}\pi\right)$

$\frac{1}{2}V = 240\pi + \frac{128}{3}\pi = 282\frac{2}{3}\pi$

$\frac{1}{2}V \approx 888.02$

The truck is carrying approximately 888.02 ft^3 of oil.

47\. Strategy To find the cost:

→Find the volume. The volume is equal to the volume of a rectangular solid plus one half the volume of a cylinder. The radius of the cylinder is one half the length of the rectangular solid.

→Multiply the volume by 6.15.

Solution $r = \frac{1}{2}L = \frac{1}{2}(50) = 25$

$V = LWH + \frac{1}{2}\pi r^2 h$

$V = 50(25)(0.5) + \frac{1}{2}\pi(25)^2(0.5)$ $V = 625 + 156.25\pi$

Cost $= 6.15(625 + 156.25\pi)$

$\approx 6{,}862.62$

The cost of the floor is \$6,862.62.

48\. Strategy To find the amount of water:

→Find the volume of the two rectangular solids.

→Add them together.

→Multiply the volume in cubic meters by 1,000.

Solution $V = L_1W_1H_1 + L_2W_2H_2$

$V = (10)(5)(1) + (5)(6)(1.5)$

$V = 50 + 45 = 95$

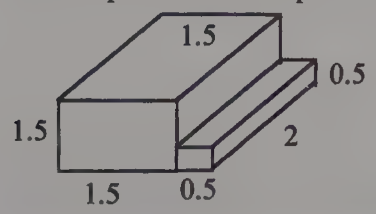
The volume is 95 m^3.

$95(1{,}000) = 95{,}000$

95,000 L of water are needed to fill the swimming pool.

Objective D Exercises, pages 571–572

49. Strategy The total surface area equals the sum of the surface area of each face of the solid. The front face is split into two squares.



Solution $SA = 2(1.5)^2 + 2(0.5)^2 + 2(1.5)(2) + 2(2)(0.5) + 1(2) + 2(2)$

$SA = 4.5 + 0.5 + 6 + 2 + 2 + 4 = 19$

The surface area is 19 m^2.

50. Strategy The total surface area equals the surface area of the rectangular solid minus the top of the solid plus one half the surface area of the cylinder. The radius of the cylinder is one half the width of the rectangular solid.

Solution $r = \frac{1}{2}d = \frac{1}{2}(6) = 3$

$SA = 2LW + 2LH + 2WH - LW + \frac{1}{2}\left(2\pi r^2 + 2\pi rh\right)$

$SA = LW + 2LH + 2WH + \pi r^2 + \pi rh$

$SA = (24)(6) + 2(24)(4) + 2(6)(4) + \pi(3)^2 + \pi(3)(24)$

$SA = 144 + 192 + 48 + \pi(9) + 72\pi$

$SA = 384 + 81\pi$

$SA \approx 638.47$

The surface area is $(384 + 81\pi)$ in^2.

The surface area is approximately 638.47 in^2.

51. Strategy The total surface area equals the surface area of a cylinder, minus one end of the cylinder, plus the surface area of a cone, minus the bottom of the cone. The radius of the cone is one half the diameter of the cylinder.

Solution $r = \frac{1}{2}d = \frac{1}{2}(6) = 3$

$SA = \left(2\pi r^2 + 2\pi rh\right) - \pi r^2 + \left(\pi r^2 + \pi rl\right) - \pi r^2$

$SA = \pi r^2 + 2\pi rh + \pi rl$

$SA = \pi(3)^2 + 2\pi(3)(10) + \pi(3)(8)$

$SA = 9\pi + 60\pi + 24\pi = 93\pi$

$SA \approx 292.17$

The surface area of the solid is 93π cm^2.

The surface area of the solid is approximately 292.17 cm^2.

52. Strategy The total surface area equals the surface area of a cylinder minus one end of the cylinder, plus one half the surface area of a sphere. The radius of the sphere is one half the diameter of the cylinder.

Solution $r = \frac{1}{2}d = \frac{1}{2}(6) = 3$

$SA = \left(2\pi r^2 + 2\pi rh\right) - \pi r^2 + \frac{1}{2}\left(4\pi r^2\right)$

$SA = 3\pi r^2 + 2\pi rh$

$SA = 3\pi(3)^2 + 2\pi(3)(12)$

$SA = 3\pi(9) + 72\pi$

$SA = 27\pi + 72\pi$

$SA = 99\pi$

$SA \approx 311.02$

The surface area of the solid is 99π ft^2.

The surface area of the solid is approximately 311.02 ft^2.

53. Strategy The total surface area equals the surface area of a cylinder, minus one end of the rectangular solid, plus the surface area of the rectangular solid, minus one end of the rectangular solid.

Solution $SA = \left(2\pi r^2 + 2\pi rh\right) - WH + (2LW + 2LH + 2WH) - WH$

$SA = 2\pi r^2 + 2\pi rh + 2LW + 2LH$

$SA = 2\pi(8)^2 + 2\pi(8)(2) + 2(15)(2) + 2(15)(2)$

$SA = 2\pi(64) + 32\pi + 60 + 60$

$SA = 128\pi + 32\pi + 120 = 160\pi + 120$

$SA \approx 622.65$

The surface area of the solid is $(160\pi + 120)$ m^2.

The surface area of the solid is approximately 622.65 m^2.

54. Strategy The total surface area equals the surface area of the rectangular solid, minus the two ends of the cylinder, plus the surface area of the cylinder, minus the two ends of the cylinder. The radius is one half the diameter of the cylinder.

Solution $r = \frac{1}{2}d = \frac{1}{2}(28) = 14$

$SA = (2LW + 2LH + 2WH) - 2\pi r^2 + \left(2\pi r^2 + 2\pi rh\right) - 2\pi r^2$

$SA = 2LW + 2LH + 2WH + 2\pi rh - 2\pi r^2$

$SA = 2(80)(40) + 2(80)(30) + 2(40)(30) + 2\pi(14)(80) - 2\pi\left(14^2\right)$

$SA = 6{,}400 + 4{,}800 + 2{,}400 + 2{,}240\pi - 2\pi(196)$

$SA = 13{,}600 + 2{,}240\pi - 392\pi$

$SA = 13{,}600 + 1{,}848\pi$

$SA \approx 19{,}405.66$

The surface area of the solid is $(13{,}600 + 1{,}848\pi)$ m^2.

The surface area of the solid is approximately 19,405.66 m^2.

55. Strategy The total surface area equals the surface area of a cone, minus the bottom of the cone, plus one half the surface area of a sphere. The radius of the sphere is one half the diameter of the base of the cone.

Solution $r=\frac{1}{2}d=\frac{1}{2}(8)=4$

$SA=\left(\pi r^2+\pi rl\right)-\pi r^2+\frac{1}{2}\left(4\pi r^2\right)$

$SA=\pi rl+2\pi r^2$

$SA=\pi(4)(6)+2\pi\left(4^2\right)$

$SA=24\,\pi+2\pi(16)$

$SA=24\pi+32\pi=56\pi$

$SA\approx 175.93$

The surface area of the solid is 56π cm^2.

The surface area of the solid is approximately 175.93 cm^2.

56. Strategy The total surface area equals the surface area of the rectangular solid, minus the cross sectional area of the cylinder $(2\cdot 8)$, minus one half the surface of the ends of the cylinder, plus one half the surface area of a cylinder, minus one half the surface area of the ends of the cylinder. The radius of the cylinder is one half the diameter of the cylinder.

Solution $r=\frac{1}{2}d=\frac{1}{2}(2)=1$

$SA=(2LW+2LH+2WH)-(2\cdot 8)-\frac{1}{2}\left(2\pi r^2\right)+\frac{1}{2}\left(2\pi r^2+2\pi rh\right)-\frac{1}{2}\left(2\pi r^2\right)$

$SA=2LW+2LH+2WH-16-\pi r^2+\pi rh$

$SA=2(8)(4)+2(8)(4)+2(4)(4)-16-\pi\left(1^2\right)+\pi(1)(8)$

$SA=64+64+32-16-\pi+8\pi$

$SA=144+7\pi$

$SA\approx 165.99$

The surface area of the solid is $(144+7\pi)$ cm^2.

The surface area of the solid is approximately 165.99 cm^2.

57. Strategy The surface area equals the sum of the surface areas of the ten rectangular faces of the solid. $V=2(1.2)(0.8)-\pi(0.2)^2(2)$

Solution $SA=2(8)(5)-2(3)(2)+2(8)(5)+2(8)(3)+2(8)(3)+(8)(2)+8(8)+64$

$SA=80-12+80+48+48+16+64=324$

The surface area of the solid is 324 ft^2.

58. Strategy The total surface area equals the surface area of the large cylinder, minus the surface area of one end of the small cylinder, plus the surface area of the small cylinder, minus the surface area of one end of the small cylinder.

Solution $r_1=\frac{1}{2}d_1=\frac{1}{2}(6)=3$

$r_2=\frac{1}{2}d_2=\frac{1}{2}(2)=1$

$SA=\left(2\pi r_1^2+2\pi r_1h\right)-\pi r_2^2+\left(2\pi r_2^2+2\pi r_2h\right)-\pi r_2^2$

$SA=2\pi r_1^2+2\pi r_1h+2\pi r_2h$

$SA=2\pi(3)^2+2\pi(3)(2)+2\pi(1)(4)$

$SA=2\pi(9)+12\pi+2\pi(1)(4)$

$SA=18\pi+12\pi+8\pi=38\pi$

$SA\approx 119.38$

The surface area of the solid is 38π in^2.

The surface area of the solid is approximately 119.38 in^2.

59. Strategy The total surface area equals the surface area of the rectangular solid, minus the cross sectional area of the cylinder $(2 \cdot 6)$, plus one half the surface area of a cylinder. The radius of the cylinder is one half the width of the solid.

Solution $r = \frac{1}{2}W = \frac{1}{2}(6) = 3$

$$SA = (2LW + 2LH + 2WH) - (2 \cdot 6) + \frac{1}{2}\left(2\pi r^2 + 2\pi rh\right)$$

$$SA = 2(9)(6) + 2(9)(1) + 2(6)(1) - 12 + \pi\left(3^2\right) + \pi(3)(2)$$

$SA = 108 + 18 + 12 - 12 + 9\pi + 6\pi$

$SA = 126 + 15\pi$

$SA \approx 173.12$

The surface area of the solid is $(126 + 15\pi)$ in^2.

The surface area of the solid is approximately 173.12 in^2.

60. Strategy The total surface area equals the surface area of the rectangular solid, minus the top of the rectangular solid, plus the surface area of the pyramid, minus the bottom of the pyramid.

Solution $SA = (2LW + 2LH + 2WH) - LW + \left(s^2 + 2sl\right) - s^2$

$SA = LW + 2LH + 2WH + 2sl$

$SA = 8(8) + 2(8)(2) + 2(8)(2) + 2(8)(5)$

$SA = 64 + 32 + 32 + 80$

$SA = 208$

The surface area of the solid is 208 in^2.

61. Strategy To find the number of cans of paint:

→Find the surface area. The surface area equals the surface area of the sides of the rectangular solid, plus one half the surface area of the cylinder. The radius of the cylinder is one half the width of the rectangular solid.

→Divide the surface area by 250.

Solution $r = \frac{1}{2}W = \frac{1}{2}(94) = 47$

$$SA = 2LH + 2WH + \frac{1}{2}\left(2\pi r^2 + 2\pi rh\right)$$

$$SA = 2LH + 2WH + \pi r^2 + \pi rh$$

$$SA = 2(125)(32) + 2(94)(32) + \pi\left(47^2\right) + \pi(47)(125)$$

$SA = 8{,}000 + 6{,}016 + 2{,}209\pi + 5{,}875\pi$

$SA = 14{,}016 + 8{,}084\pi$

$SA \approx 39{,}412.63$

$39{,}412.63 \div 250 \approx 157.65$

158 cans should be purchased to paint the auditorium.

62. Strategy To find the total number of grams:

→Find the surface area. The surface area equals the surface area of a cylinder, minus the top of the cylinder, plus the surface area of a cone, minus the surface area of the base of the cone.

→Multiply the surface by 0.24.

Solution $SA = \left(2\pi r^2 + 2\pi rh\right) - \pi r^2 + \left(\pi r^2 + \pi rl\right) - \pi r^2$

$SA = \pi r^2 + 2\pi rh + \pi rl$

$SA = \pi\left(5^2\right) + 2\pi(5)(3) + \pi(5)(10)$

$SA = \pi(25) + 30\pi + 50\pi = 105\pi$

$SA \approx 329.87$

$329.87 \cdot 0.24 \approx 79.17$

The total weight of the metal is approximately 79.17 g.

63. Strategy To find the cost:

→Find the surface area. Two walls are 25.5 by 8, two walls are 22 by 8. Subtract the area of the doors and windows.

→Multiply the surface area by 1.50.

Solution $SA = 2(25.5)(8) + 2(22)(8) - 2(2.5)(7) - 6(2.5)(4)$

$SA = 408 + 352 - 35 - 60 = 665$

$665 \cdot 1.50 = 997.50$

The cost to plaster the room is $997.50.

Critical Thinking 9.5, page 572

64. Area of the sides: $2[36(10)] = 720$

Area of the top: $10(36) = 360$

Area of the front: $2(1)(36) + 4(1)(34) = 208$

Area of the inside:

Back $34(34) - 2(1)(34) = 1156 - 68 = 1{,}088$

sides $2(10)(34) - 4(10)(1) = 680 - 40 = 640$

shelves $6(10)(34) = 2{,}040$

Total area = 720 + 360 + 208 + 1,088 + 640 + 2,040

Total area = 5,056 in^2

65. Length = carton width + diameter of bottle + cardboard width + diameter of bottle + cardboard width + diameter of bottle + cardboard width.

Length $= \frac{1}{8} + 4 + \frac{1}{16} + 4 + \frac{1}{16} + 4 + \frac{1}{8} = 12\frac{3}{8}$ in.

Width = carton width + diameter of bottle + cardboard width + diameter of bottle + cardboard width

Width $= \frac{1}{8} + 4 + \frac{1}{16} + 4 + \frac{1}{8} = = 8\frac{5}{16}$ in.

Height = carton width + height of bottle + carton width

Height $= \frac{1}{8} + 8 + \frac{1}{8} = 8\frac{1}{4}$ in.

The dimensions of the shipping carton are $12\frac{3}{8}$ in. × $8\frac{5}{16}$ in. × $8\frac{1}{4}$ in.

66. SA of sphere $= 4\pi r^2$

SA of the side of the cylinder $= 2\pi rh = 2\pi r(2r) = 4\pi r^2$

Chapter Review Exercises, pages 577–578

1. Strategy →To find the measure of $\angle c$, use the fact that the sum of an interior and exterior angle is 180°. $V = LWH - \pi r^2 h$
→To find the measure of $\angle x$, use the fact that the sum of the measurements of the interior angles of a triangle is 180°.
→To find the measure of $\angle y$, use the fact that the sum of an interior and exterior angle is 180°.

Solution
$\angle a + \angle c = 180°$
$74° + \angle c = 180°$
$\angle c = 106°$
$\angle b + \angle c + \angle x = 180°$
$52° + 106° + \angle x = 180°$
$158° + \angle x = 180°$
$\angle x = 22°$
$\angle x + \angle y = 180°$
$22° + \angle y = 180°$
$\angle y = 158°$

2. Strategy To find the perimeter:
→Find AC by writing a proportion, using the fact that in similar triangles, the ratios of corresponding sides are equal.
→Use the formula for finding the perimeter of a triangle.

Solution
$\frac{AC}{DF} = \frac{BC}{EF}$
$\frac{AC}{12} = \frac{6}{9}$
$9(AC) = 12(6)$
$9(AC) = 72$
$AC = 8$
$P = AB + BC + AC$
$P = 10 + 6 + 8$
$P = 24$
The perimeter of the triangle is 24 in.

3. Strategy The volume is equal to the volume of the rectangular solid with dimensions 8 by 7 by 6, minus the rectangular solid with dimensions 8 by 4 by 3.

Solution
$V = L_1V_1H_1 - L_2V_2H_2$
$V = 8(7)(6) - 8(4)(3)$
$V = 336 - 96$
$V = 240$
The volume of the solid is 240 in^3.

4. Strategy To find the measure of $\angle x$, use the fact that adjacent angles of intersecting lines are supplementary.

Solution
$112° + \angle x = 180°$
$\angle x = 68°$
The measure of $\angle x$ is 68°.

5. Strategy To determine if the triangles are congruent, determine if one of the rules for congruence is satisfied.

Solution $BC = DE, AC = DF,$
$\angle C = \angle D$
Two sides and the included angle of one triangle equal two sides and the included angle of the other triangle.
The triangles are congruent by the SAS rule.

6. Strategy The total surface area equals the surface area of a cylinder, minus the surface area of one end of the cylinder, plus one half the surface area of a sphere. The radius of the sphere is one half the diameter of the cylinder.

Solution
$$r = \frac{1}{2}d = \frac{1}{2}(4) = 2$$
$$SA = \left(2\pi r^2 + 2\pi rh\right) - \pi r^2 + \frac{1}{2}\left(4\pi r^2\right)$$
$$SA = 3\pi r^2 + 2\pi rh$$
$$SA = 3\pi(2)^2 + 2\pi(2)(8)$$
$$SA = 3\pi(4) + 32\pi$$
$$SA = 12\pi + 32\pi$$
$$SA = 44\pi$$
$$SA \approx 138.23$$
The surface area of the solid is approximately 138.23 m^2.

7. $AC = AB + BC$
$AC = 3(BC) + BC$
$AC = 4(BC)$
$AC = 4(11)$
$AC = 44$
The length of AC is 44 cm.

8. Strategy The sum of the measures of the three angles shown is 180°. To find x, write an equation and solve for x.

Solution
$$4x + 3x + (x + 28°) = 180°$$
$$8x + 28° = 180°$$
$$8x = 152°$$
$$x = 19°$$
The measure of x is 19°.

9. Strategy The area is equal to the area of the rectangle plus one half the area of a circle. The radius of the circle is one half the length of the rectangle.

Solution
$$r = \frac{1}{2}L = \frac{1}{2}(8) = 4$$
$$A = LW + \frac{1}{2}\pi r^2$$
$$A = 8(4) + \frac{1}{2}\pi\left(4^2\right)$$
$$A = 32 + \frac{1}{2}\pi(16)$$
$$A = 32 + 8\pi$$
$$A \approx 57.13$$
The area is approximately 57.13 in^2.

10. Strategy To find the volume, use the formula for the volume of a pyramid. $s = 6$, $h = 8$.

Solution $V = \frac{1}{3}s^2h$
$V = \frac{1}{3}(6^2)(8)$
$V = \frac{1}{3}(36)(8)$
$V = 96 \text{ cm}^3.$
The volume of the pyramid is 96 cm^3.

11. Strategy The perimeter is equal to two sides of a triangle plus one half the circumference of a circle.

Solution $P = a + b + \frac{1}{2}\pi d$
$P = 16 + 16 + \frac{1}{2}\pi(10)$
$P = 32 + 5\pi$
$P \approx 47.71$
The perimeter is approximately 47.71 in.

12. Strategy $\angle a = 138°$ because alternate interior angles of parallel lines are equal.
$\angle a + \angle b = 180°$ because adjacent angles of intersecting lines are supplementary.

Solution $\angle a = 138°$
$\angle a + \angle b = 180°$
$138° + \angle b = 180°$
$\angle b = 42°$
The measure of $\angle b$ is 42°.

13. Strategy To find the surface area, use the formula for the surface area of a rectangular solid.
$L = 10$, $W = 5$, $H = 4$.

Solution $SA = 2LW + 2LH + 2WH$
$SA = 2(10)(5) + 2(10)(4) + 2(5)(4)$
$SA = 100 + 80 + 40$
$SA = 220$
The surface area of the solid is 220 ft^2.

14. Strategy To find the measure of the other leg, use the Pythagorean Theorem.
$c = 12$, $a = 7$.

Solution $a^2 + b^2 = c^2$
$7^2 + b^2 = 12^2$
$49 + b^2 = 144$
$b^2 = 95$
$b = \sqrt{95}$
$b \approx 9.75$
The other leg is approximately 9.75 ft.

15. Strategy To find the volume, use the formula for the volume of a cube. $s = 3.5$.

Solution $V = s^3$
$V = (3.5)^3$
$V = 42.875$
The volume of the cube is 42.875 in^3.

16. Strategy Supplementary angles are two angles whose sum is 180°. To find the supplement, let x represent the supplement of a 32° angle. Write an equation and solve for x.

Solution $32° + x = 180°$
$x = 148°$
The supplement of a 32° angle is a 148° angle.

17. Strategy To find the volume, use the formula for the volume of a rectangular solid.
$L = 6.5$, $W = 2$, $H = 3$.

Solution $V = LWH$
$V = (6.5)(2)(3)$
$V = 39$
The volume of the solid is 39 ft^3.

18. Strategy To find the third angle, use the fact that the sum of the measures of the interior angles of a triangle is 180°. Let $x =$ the third angle.

Solution $37° + 48° + x = 180°$
$85° + x = 180°$
$x = 95°$
The third angle is 95°.

19. Strategy To find the base, use the formula for the area of a triangle. Substitute 7 for h and 28 for A and solve for b.

Solution
$A = \frac{1}{2}bh$
$28 = \frac{1}{2}b(7)$
$56 = 7b$
$8 = b$
The base of the triangle is 8 cm.

20. Strategy To find the volume, use the formula for the volume of a sphere. The radius of the sphere is one half the diameter.

Solution
$r = \frac{1}{2}d = \frac{1}{2}(12) = 6$
$V = \frac{4}{3}\pi r^3$
$V = \frac{4}{3}\pi\left(6^3\right)$
$V = \frac{4}{3}\pi(216)$
$V = 288\pi$
The volume of the sphere is 288π mm^3.

21. Strategy To find the length of each side, use the formula for the perimeter of a square. $P = 86$.

Solution
$P = 4s$
$86 = 4s$
$21.5 = s$
A side of the square is 21.5 cm.

22. Strategy To find the number of cans of paint:
→Find the surface area by using the formula for the surface area of a cylinder.
→Divide the surface area by 200.

Solution
$SA = 2\pi r^2 + 2\pi rh$
$SA = 2\pi\left(6^2\right) + 2\pi(6)(15)$
$SA = 2\pi(36) + 180\pi$
$SA = 72\pi + 180\pi$
$SA = 252\pi$
$252\pi \div 200 \approx 3.96$
Because a portion of a fourth can is needed, 4 cans of paint should purchased.

23. Strategy To find the amount of fencing, use the formula for the perimeter of a rectangle.

Solution
$P = 2L + 2W$
$P = 2(56) + 2(48)$
$P = 112 + 96$
$P = 208$
208 yd of fencing are needed to fence the park.

24. Strategy To find the area, use the formula for the area of a square. $s = 9.5$.

Solution
$A = s^2$
$A = (9.5)^2$
$A = 90.25$
The area of the patio is 90.25 m^2.

25. Strategy To find the area of the walkway:
→Find the length and width of the total area.
→Subtract the area of the plot of grass from the total area.

Solution
$L_1 = 40 + 2 + 2 = 44$
$W_1 = 25 + 2 + 2 = 29$
$A = L_1W_1 - L_2W_2$
$A = 44(29) - 40(25)$
$A = 1{,}276 - 1{,}000$
$A = 276$
The area of the walkway is 276 m^2.

Chapter Test, pages 579–580

1. Strategy: To find the measure of the other leg, use the Pythagorean Theorem. $c = 11$, $a = 8$.

Solution:
$a^2 + b^2 = c^2$
$8^2 + b^2 = 11^2$
$64 + b^2 = 121$
$b^2 = 57$
$b = \sqrt{57}$
$b \approx 7.55$
The other leg is approximately 7.55 cm.

2. Strategy: To determine if the triangles are congruent, determine if one of the rules for congruence is satisfied.

Solution: $AC = AC$, $AB = AB$,
$\angle A = \angle A$
Two sides and the included angle of one triangle equal two sides and the included angle of the other triangle.
The triangles are congruent by the SAS rule.

3. Strategy: To find the area, use the formula for the area of a rectangle. Substitute 15 for L and 7.4 for W. Solve for A.

Solution:
$A = LW$
$A = 15(7.4)$
$A = 111$
The area is 111 m^2.

4. Strategy: To find the area, use the formula for the area of a triangle. Substitute 7 for b and 12 for h. Solve for A.

Solution:
$A = \frac{1}{2}bh$
$A = \frac{1}{2}(7)(12)$
$A = 42$
The area is 42 ft^2.

5. Strategy: To find the volume, use the formula for the volume of a cone. $r = 7$, $h = 16$.

Solution:
$V = \frac{1}{3}\pi r^2 h$
$V = \frac{1}{3}\pi(7)^2(16)$
$V = \frac{1}{3}\pi(49)(16)$
$V = \frac{784\pi}{3}$
The volume is $\frac{784\pi}{3}$ in^3.

6. Strategy: To find the surface area, use the formula for the surface area of a pyramid. $s = 3$, $l = 11$.

Solution:
$SA = s^2 + 2sl$
$SA = 3^2 + 2(3)(11)$
$SA = 9 + 66$
$SA = 75$
The surface area of the pyramid is 75 m^2.

7. Strategy: The volume is equal to the volume of the cylinder plus the volume of the cone. $h_1 = 30$, $h_2 = 12$, $r = 7$

Solution:
$V = \pi r^2 h_1 + \frac{1}{3}\pi r^2 h_2$
$V = \pi(7)^2(30) + \frac{1}{3}\pi(7)^2(12)$
$V = \pi(49)(30) + \frac{1}{3}\pi(49)(12)$
$V = 1{,}470\pi + 196\pi = 1{,}666\pi$
$V \approx 5{,}233.89$
The volume of the solid is $1{,}666\pi$ cm^3.
The volume of the solid is approximately 5,233.89 cm^3.

8. Strategy: To find the area, use the formula for the area of a trapezoid. Substitute 20 for b_1, 33 for b_2, and 6 for h. Solve for A.

Solution:
$A = \frac{1}{2}h(b_1 + b_2)$
$A = \frac{1}{2} \cdot 6(20 + 33)$
$A = 159$
The area is 159 in^2.

9. Strategy The perimeter is the sum of two sides of a rectangle plus two half circles.

Solution $P = 2L + 2\left(\frac{1}{2}\pi d\right)$
$P = 2(11) + \pi(6)$
$P = 22 + 6\pi$
$P \approx 40.8$
The perimeter is $(22 + 6\pi)$ ft.
The perimeter is approximately 40.8 ft.

10. Strategy The total surface area equals the surface area of the rectangular solid, minus the top of the rectangular solid, plus the surface area of the pyramid, minus the bottom of the pyramid.

Solution $SA = (2LW + 2LH + 2WH)$
$\quad - LW + (s^2 + 2sl) - s^2$
$SA = LW + 2LH + 2WH + 2sl$
$SA = 5(5) + 2(5)(3) + 2(5)(5)$
$\quad + 2(5)(5)$
$SA = 25 + 30 + 50 + 50$
$SA = 155$
The surface area of the solid is 155 m^2.

11. Strategy The angles labeled are adjacent angles of intersecting lines and are, therefore, supplementary angles. To find x, write an equation and solve for x.

Solution $4x + 10° + x = 180°$
$5x = 170°$
$x = 34°$
The measure of x is 34°.

12. The polygon has 8 sides.
The polygon is an octagon.

13. Strategy To determine whether the triangles are congruent, determine whether one of the rules for congruence is satisfied.

Solution The triangles do not satisfy the SSS Rule, the SAS Rule, or the ASA Rule. The triangles are not necessarily congruent.

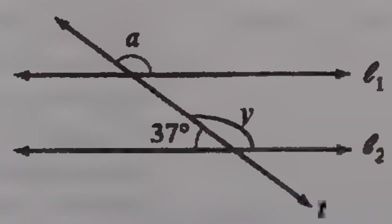
14. Strategy To find the volume, use the formula for the volume of a rectangular solid.
$L = 6, W = 7, H = 4$.

Solution $V = LWH$
$V = 6(7)(4) = 168$
The volume of the rectangular solid is 168 ft^3.

15. Strategy To find the hypotenuse, use the Pythagorean Theorem.
$a = 4, b = 7$

Solution $c^2 = a^2 + b^2$
$c^2 = 4^2 + 7^2$
$c^2 = 16 + 49 = 65$
$c = \sqrt{65}$
$c \approx 8.06$
The length of the hypotenuse if approximately 8.06 m.

16. Strategy



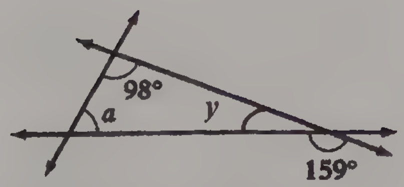
$y = a$ because corresponding angles have the same measure.
$y + 37° = 180°$ because adjacent angles of intersecting lines are supplementary angles. Substitute a for y and solve for a.

Solution $a + 37° = 180°$
$a = 143°$
The measure of a is 143°.

17. Strategy To find the surface area, use the formula for the surface area of a cylinder. $r = 10$, $h = 15$.

Solution $SA = 2\pi r^2 + 2\pi rh$
$SA = 2\pi(10^2) + 2\pi(10)(15)$
$SA = 2\pi(100) + 300\pi$
$SA = 200\pi + 300\pi = 500\pi$
The surface area of the cylinder is 500π cm^2.

18. Strategy



→To find the measure of $\angle y$, use the fact that $\angle y$ and 159° are supplemental angles.
→To find the measure of $\angle a$ by using the fact that the sum of the interior angles of a triangle is 180°.

Solution
$\angle y + 159° = 180°$
$\angle y = 21°$
$21° + 98° + \angle a = 180°$
$119° + \angle a = 180°$
$\angle a = 61°$
The measure of $\angle a$ is 61°.

19. Strategy: To find the length of side *FG*, write a proportion using the fact that, in similar triangles, the ratio of corresponding sides equals the ratio of corresponding heights. Solve the proportion for the height *h*.

Solution
$\frac{EF}{BC} = \frac{h}{5}$
$\frac{12}{9} = \frac{h}{5}$
$5(12) = 9h$
$60 = 9h$
$6.66 \approx h$
The length of line segment *FG* is approximately 6.66 ft.

20. Strategy: To find *BC*, write a proportion using the fact that in similar triangles, the ratios of corresponding sides are equal. Solve the proportion for *BC*.

Solution
$\frac{BC}{EF} = \frac{AB}{DE}$
$\frac{BC}{8} = \frac{8}{15}$
$15BC = (8)8$
$15BC = 64$
$BC \approx 4.27$
The length of *BC* is approximately 4.27 ft.

21. Strategy: To find the perimeter, use the formula for the perimeter of a square. Substitute 5 for *s*. Solve for *P*.

Solution
$P = 4s$
$P = 4(5)$
$P = 20$
The perimeter is 20 m.

22. Strategy: To find the perimeter, use the formula for the perimeter of a rectangle. Substitute 8 for *L* and 5 for *W*. Solve for *P*.

Solution
$P = 2L + 2W$
$P = 2(8) + 2(5)$
$P = 16 + 10$
$P = 26$
The perimeter is 26 cm.

23. Strategy: To find the perimeter:
→Use the Pythagorean Theorem to find the hypotenuse of the triangle. $a = 12, b = 18$
→Use the formula for the perimeter of a triangle to find the perimeter.

Solution
$c^2 = a^2 + b^2$
$c^2 = 12^2 + 18^2$
$c^2 = 144 + 324$
$c^2 = 468$
$c = \sqrt{468}$
$c \approx 21.6$
$P = a + b + c$
$P = 12 + 18 + 21.6$
$P = 51.6$
The perimeter is approximately 51.6 ft.

24. Strategy To find the third angle, use the fact that the sum of the measures of the interior angles of a triangle is 180°. Let $x =$ the third angle.

Solution
$41° + 37° + x = 180°$
$78° + x = 180°$
$x = 102°$
The third angle is 102°.

25. Strategy The area is equal to the area of a rectangle minus $\frac{1}{2}$ the area of a circle. The width of the rectangle is equal to twice the radius of the circle (3).

Solution
$W = 2r = 2(3) = 6$
$A = LW - \frac{1}{2}\pi r^2$
$A = 12(6) - \frac{1}{2}\pi(3)^2$
$A = 72 - \frac{1}{2}\pi(9)$
$A = 72 - 4.5\pi$
$A \approx 58.9$
The area is $(72 - 4.5\pi)$ ft^2.
The area is approximately 57.9 ft^2.

Cumulative Review Exercises, pages 581–582

1. Strategy To find the amount, use the basic percent equation.
Percent = 8.5% = 0.085,
base = 2,400, amount = n.

Solution
Percent · base = amount
$0.085(2,400) = n$
$204 = n$
8.5% of 2,400 is 204.

2. $78 \div 1 = 78$
$78 \div 2 = 39$
$78 \div 3 = 26$
$78 \div 6 = 13$
$78 \div 13 = 6$
The factors of 78 are 1, 2, 3, 6, 13, 26, 39, and 78.

3. $4\frac{2}{3} \div 5\frac{3}{4} = \frac{14}{3} \div \frac{28}{5}$
$= \frac{14}{3} \cdot \frac{5}{28}$
$= \frac{14 \cdot 5}{3 \cdot 28}$
$= \frac{2 \cdot 7 \cdot 5}{3 \cdot 2 \cdot 2 \cdot 7}$
$= \frac{5}{6}$

4. $(3x^2 + 5x - 2) + (4x^2 - x + 7)$
$= (3x^2 + 4x^2) + (5x - x) + (-2 + 7)$
$= 7x^2 + 4x + 5$

5. $82.93 \div 6.5 \approx 12.8$

6. $0.000029 = 2.9 \times 10^{-5}$

7. Strategy To find the measure of $\angle x$, use the fact that adjacent angles of intersecting lines are supplementary.

Solution
$\angle x + 49° = 180°$
$\angle x = 131°$
The measure of $\angle x$ is 131°.

8. Strategy To find the hypotenuse, use the Pythagorean Theorem.
$a = 10$, $b = 24$.

Solution
$c^2 = a^2 + b^2$
$c^2 = 10^2 + 24^2$
$c^2 = 100 + 576$
$c^2 = 676$
$c = \sqrt{676}$
→C is the square root of 676.
$c = 26$
The length of the hypotenuse is 26 cm.

9. Strategy To find the area, use the formula for the area of a trapezoid. $h = 5$, $b_1 = 16$, $b_2 = 4$.

Solution
$A = \frac{1}{2}h(b_1 + b_2)$
$A = \frac{1}{2} \cdot 5(16 + 4)$
$A = \frac{5}{2}(20) = 50$
The area is 50 in^2.

10. Strategy The volume is equal to the volume of the large cylinder minus the volume of the small cylinder.

Solution $V=\pi r_1^2L-\pi r_2^2L$

$V=\pi(6^2)(14)-\pi(2^2)(14)$

$V=\pi(36)(14)-\pi(4)(14)$

$V=504\pi-56\pi=448\pi$

$V\approx 1{,}407.43$

The volume is approximately 1,407.43 cm^3.

11. $(4x^2y^2)(-3x^3y)$
$=[4(-3)](x^2\cdot x^3)(y^2\cdot y)$
$=-12x^5y^3$

12. $3(2x+5)=18$
$6x+15=18$
$6x=3$
$x=\frac{1}{2}$
The solution is $\frac{1}{2}$.

13. Strategy The perimeter equals three sides of a rectangle plus one half the circumference of a circle.

Solution $P=3+2+3+\frac{1}{2}(\pi d)$

$P=8+\frac{1}{2}\pi(2)$

$P=8+\pi$

$P\approx 11.14$

The perimeter is approximately 11.14 cm.

14. The real numbers greater than −3 are to the right of −3 on the number line. Draw a parenthesis at −3. Draw a heavy line to the right of −3. Draw an arrow at the right of the line.

15. $5(2x+4)-(3x+2)=10x+20-3x-2$
$=7x+18$

16. $2x+3y^2z$
$2(5)+3(-1)^2(-4)=2(5)+3(1)(-4)$
$=10+(-12)$
$=-2$

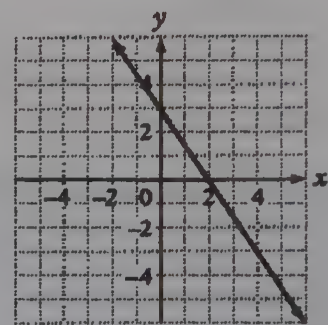
19. x^2y-2z
$\left(\frac{1}{2}\right)^2\left(\frac{4}{5}\right)-2\left(-\frac{3}{10}\right)=\frac{1}{4}\left(\frac{4}{5}\right)-2\left(\frac{-3}{10}\right)$
$=\frac{1}{5}-\frac{-3}{5}$
$=\frac{1}{5}+\frac{3}{5}$
$=\frac{4}{5}$

18. $60\text{mph}=\frac{60\text{ mi}}{\text{h}}\cdot\frac{1.61\text{km}}{1\text{mi}}=96.6\text{km/h}$

19. $4x+2=6x-8$
$4x-6x+2=6x-6x-8$
$-2x+2=-8$
$-2x+2-2=-8-2$
$-2x=-10$
$\frac{-2x}{-2}=\frac{-10}{-2}$
$x=5$
The solution is 5.

20.

x	y
2	0
0	3
−2	6



21. 3,482 m = 3.482 km

22. $\frac{3}{8}=\frac{3}{8}(100\%)=37\frac{1}{2}\%$

23. Strategy To find the simple interest, solve the simple interest formula $I=Prt$ for I.

$P=20{,}000,\ t=\frac{270}{365},$

$r=0.08875$

Solution $I=Prt$

$I=(20{,}000)(0.08875)\left(\frac{270}{365}\right)$

$I=1{,}313.01$

The interest on the loan is $1,313.01.

24. Strategy

To find the amount of coffee:
→Multiply the number of people (250) by the amount of coffee consumed by each person (12).
→Use the following conversion factors: $\frac{1\text{c}}{8\text{ oz}}$, $\frac{1\text{ pt}}{2\text{ c}}$, $\frac{1\text{ qt}}{2\text{ pt}}$ and $\frac{1\text{ gal}}{4\text{ qt}}$.

Solution

$250 \cdot 12 = 3{,}000$ oz
$3{,}000$ oz $=$
$$\frac{3{,}000\text{ oz}}{1} \cdot \frac{1\text{ c}}{8\text{ oz}} \cdot \frac{1\text{ pt}}{2\text{ c}} \cdot \frac{1\text{ qt}}{2\text{ pt}} \cdot \frac{1\text{ gal}}{4\text{ qt}}$$
$= 23.4375$ gal
23 gal of coffee should be prepared for the reception.

25. Strategy

To find the charge for phone service, write and solve an equation using n to represent the number of minutes the phone is used.

Solution

$\text{Cost} = 42 + 0.35n$
$72.45 = 42 + 0.35n$
$30.45 = 0.35n$
$87 = n$
The phone service was used for 87 min.

26. Strategy

To find the sales tax, write and solve a proportion using n to represent the sales tax.

Solution

$$\frac{0.75}{12.50} = \frac{n}{75}$$
$0.75(75) = 12.50 \cdot n$
$56.25 = 12.50n$
$$\frac{56.25}{12.50} = \frac{12.50n}{12.50}$$
$4.50 = n$
The sales tax is \$4.50.

27. Strategy

To find the percent decrease:
→Subtract 18.3 from 25.6 to find the amount of decrease.
→Use the basic percent equation. Percent $= n$, base $= 25.6$, amount $=$ amount of decrease.

Solution

$25.6 - 18.3 = 7.3$
Percent $\cdot$ base $=$ amount
$n \cdot 25.6 = 7.3$
$$n = \frac{7.3}{25.6}$$
$n \approx 0.285 = 28.5\%$
The percent decrease is 28.5%.

28. Strategy

To find the height of the box, use the formula for the volume of a rectangular solid. $V = 144$, $L = 12$, $W = 4$.

Solution

$V = LWH$
$144 = 12(4)H$
$144 = 48H$
$3 = H$
The height of the box is 3 ft.

29. Strategy

To find the pressure, substitute 35 for P in the given equation and solve for D.

Solution

$$P = 15 + \frac{1}{2}D$$
$$35 = 15 + \frac{1}{2}D$$
$$20 = \frac{1}{2}D$$
$40 = D$
The depth is 40 ft.

30. Strategy

To find the distance, substitute 196 for E and 49 for S and solve for d.

Solution

$$d = 4{,}000\sqrt{\frac{E}{S}} = 4{,}000$$
$$d = 4{,}000\sqrt{\frac{196}{49}} - 4{,}000$$
$d = 4{,}000\sqrt{4} - 4{,}000$
$d = 4{,}000(2) - 4{,}000$
$d = 8{,}000 - 4{,}000$
$d = 4{,}000$
The explorer is 4,000 mi above the surface.

Chapter 10

Section 10.1

Objective A Exercises, pages 589–590

3. Range = 86 – 22 = 64

4. Strategy: To prepare the frequency distribution table, find the range. Then divide the range by 8, the number of classes. If necessary, round the quotient to a whole number. This is the class width.

Solution: range = 86 – 22 = 64

class width $= \frac{64}{8} = 8$

Annual Tuition of Universities

Classes	Tally	Frequency
22–30	////	4
31–39	/////	5
40–48	/////	5
49–57	/////	5
58–66	////	4
67–75	////	4
76–84	/////////	9
85–93	////	4

5. Strategy: To find the class with the greatest frequency, refer to the frequency table in Exercise 3.

Solution: The class with the greatest frequency is 76–84.

6. Strategy: To find how many universities charge a tuition between \$6,700 and \$7,500, refer to the frequency table in Exercise 3.

Solution: 4 universities charge a tuition between \$6,700 and \$7,500.

7. Strategy: To find how many universities charge a tuition between \$4,000 and \$4,800, refer the frequency table in Exercise 3.

Solution: 5 universities charge a tuition between \$4,000 and \$8,000.

8. Strategy: To find how many universities charge a tuition less than or equal to \$5,700, refer to the frequency table in Exercise 3.

Solution: Number of universities

$= 4 + 5 + 5 + 5$

$= 19$

9. Strategy: To find the percent:

→Use Exercise 3 to find the number of universities that charge a tuition between \$8,500 and \$9,300.

→Use the basic percent equation.

Solution: Number of universities = 4

Percent · base = amount

$p(40) = 4$

$p = \frac{4}{40}$

$p = 0.10$

10% of the universities charge between \$8,500 and \$9,300.

10. Strategy: To find the percent:

→Use Exercise 3 to find the number of universities that charge a tuition between \$2,200 and \$3,000.

→Use the basic percent equation.

Solution: Number of universities = 4

Percent · base = amount

$p(40) = 4$

$p = \frac{4}{40}$

$p = 0.10$

10% of the universities charge between \$2,200 and \$3,000.

11. Strategy To find the percent:
→Use Exercise 3 to find the number of universities that charge a tuition greater than or equal to $5,800.
→Use the basic percent equation.

Solution Number of universities
$= 4 + 4 + 9 + 4$
$= 21$
Percent · base = amount
$p(40 = 21$
$p = \frac{21}{40}$
$p = 0.525$
52.5% of the universities charge tuition greater than or equal to $5,800.

12. Strategy To find the percent:
→Use Exercise 3 to find the number of universities that charge a tuition less than or equal to $6,600.
→Use the basic percent equation.

Solution Number of universities
$= 4 + 5 + 5 + 5 + 4$
$= 23$
Percent · base = amount
$p(40) = 23$
$p = \frac{23}{40}$
$p = 0.575$
57.5% of the universities charge tuition less than or equal to $6,600.

13. Strategy To find the frequency distribution table, find the range. Then divide the range by 7, the number of classes to obtain the class width.

Solution range = 107 – 37 = 70
class width $= \frac{70}{7} = 10$

Classes	Tally	Frequency
37—47	/////	5
48–58	//////////	10
59–69	///////	7
70–80	///////////	11
81–91	//////////	10
92–102	//////	6
103-113	/	1

14. Strategy To find the number of hotels with room rates between $59 and $69, refer to the frequency table in Exercise 13.

Solution 7 hotels charge a corporate room rate between $59 and $69.

15. Strategy To find the number of hotels with rooms rates between $37 and $47, refer to the frequency table in Exercise 13.

Solution 5 hotels charge a corporate room rate between $37 and $47.

16. Strategy To find the number of hotels:
→Refer to the frequency table in Exercise 13 to find the number of hotels with room rates between $92 and $102 and between $103 and $113.
→Add the numbers.

Solution Number of hotels with rates between:
$92 and $102: 6
$103 and $113: 1
6 + 1 = 7
7 hotels charge a corporate room rate between $92 and $113.

17. Strategy To find the number of hotels:
→Refer to the frequency table in Exercise 13 to find the number of hotels with room rates between \$27–\$47, \$48–\$58, \$59–\$69, and \$70–\$80.
→Add the numbers.

Solution Number of hotels with rates between:
\$37–\$47: 5
\$48–\$58: 10
\$59–\$69: 7
\$70–\$80: 11
$5 + 10 + 7 + 11 = 33$
33 of the hotels charge less than or equal to \$80.

18. Strategy To find the percent:
→Refer to the frequency table in Exercise 13 to find the number of hotels with room rates between \$81 and \$91.
→Use the basic percent equation.

Solution Number of hotels: 10
Percent · base = amount
$p(50) = 10$
$p = \frac{10}{50}$
$p = 0.20$
20% of the room rates are between \$81 to \$91.

19. Strategy To find the percent:
→Refer to the frequency table in Exercise 13 to find the number of hotels with room rates between \$70 and \$80.
→Use the basic percent equation.

Solution Number of hotels: 11
Percent · base = amount
$p(50) = 11$
$p = \frac{11}{50}$
$p(50) = 11$
22% of the hotels charge a corporate room rate between \$70 and \$80.

20. Strategy To find the percent:
→Refer to the frequency table in Exercise 13 to find the number of hotels with room rates greater than or equal to \$81.
→Use the basic percent equation.

Solution Number of hotels with rates between:
\$81–\$91: 10
\$92–\$102: 6
\$103–\$113: 1
$10 + 6 + 1 = 17$
Percent · base = amount
$p(50) = 17$
$p = \frac{17}{50}$
$p = 0.34$
34% of the hotels have corporate room rates equal to or above \$81.

21. Strategy To find the percent:
→Refer to the frequency table in Exercise 13 to find the number of hotels with room rates less than or equal to \$58.
→Use the basic percent equation.

Solution Number of hotels with rates between:
\$37–\$47: 5
\$48–\$58: 10
$5 + 10 = 15$
Percent · base = amount
$p(50) = 15$
$p = \frac{15}{50}$
$p = 0.30$
30% of the hotel rooms have rates less than or equal to \$58.

22. Strategy To find the ratio:
→Refer to the frequency table in Exercise 13 to find the number of hotels with room rates between \$59 and \$69 and between \$70 and \$80.
→Write the ratio:

Solution Number of hotels with rates between:
\$59–\$69: 7
\$70–\$80: 11

$$\frac{\text{Number of hotels with rates between } \$59-\$69}{\text{Number of hotels with rates between } \$70-\$80}=\frac{7}{11}$$

The ratio of the number of hotels with room rates between \$59 and \$69 to the number with room rates between \$70 and \$80 is $\frac{7}{11}$.

Objective B Exercises, page 591

23. Strategy Read the histogram to find the number of account balances between \$750 and \$1,000.

Solution There are 13 account balances between \$750 and \$1,000.

24. Strategy To find the number of account balances:
→Read the histogram to find the number of account balances between \$0–\$250, \$250–\$500, \$500– \$750, and \$750–\$1,000.
→Add the numbers.

Solution Number of account balances between:
\$0–\$250: 2
\$150–\$500: 7
\$500–\$750: 10
\$750–\$1,000: 13
$13+10+7+2=32$
There were 32 account balances less than \$1,000.

25. Strategy To find the percent:
→Read the histogram to find the number of account balances between \$750–\$1,000, \$1,000–\$1,250, and \$1,250–\$1,500.
→Add the numbers.
→Use the basic percent equation.

Solution Number of account balances between:
\$750–\$1,000: 13
\$1,000–\$1,250: 11
\$1,250–\$1,500: 7
$13+11+7=31$
Percent · base = amount
$p(50)=31$
$p=\frac{31}{50}$
$p=0.62$
62% of the account balances were above \$750.

26. Strategy To find the percent:
→Read the histogram to find the number of account balances \$1,000 to \$1,250.
→Use the basic percent equation.

Solution Number of accounts: 11
Percent · base = amount
$p(50) = 11$
$p = \frac{11}{50}$
$p = 0.22$
22% of the account balances were between \$1,000 and \$1,250.

27. Strategy To find the ratio:
→Read the histogram to find the number of runners with times between 150 min–155 min and 175 min–180 min.
→Write the ratio in simplest form.

Solution Number of runners with times between:
150 min–155 min: 5
175 min–180 min: 10
$$\frac{\text{Number of runners with times between } 150-155 \text{ min}}{\text{Number of runners with times between } 175 \text{ min} - 180 \text{ min}} = \frac{5}{10} = \frac{1}{2}$$
The ratio is $\frac{1}{2}$.

28. Strategy To find the ratio:
→Read the histogram to find the number of runners with times between 165 min–170 min and 155 min–160 min.
→Write the ratio in simplest form.

Solution Number of runners with times between:
165 min–170 min: 30
155 min–160 min: 10
$$\frac{\text{Number of runners with times between } 165-170 \text{ min}}{\text{Number of runners with times between } 155 \text{ min} - 160 \text{ min}} = \frac{3}{10} = \frac{3}{1}$$
The ratio is $\frac{3}{1}$.

29. Strategy To find the percent:
→Read the histogram to find the number of runners with times between 165 min–170 min, 170 min–175 min, and 175 min–180 min.
→Add the numbers.
→Use the basic percent equation.

Solution Number of runners with times between:
165 min–170 min: 30
170 min–175 min: 20
175 min–180 min: 10
$30 + 20 + 10 = 60$
Percent · base = amount
$p(100) = 60$
$p = \frac{60}{100}$
$p = 0.60$
60% of the runners had times greater than 165 min.

30. Strategy To find the percent:
→Read the histogram to find the number of runners with times between 150 min–155 min, 155 min–160 min, 160 min–165 min, and 165 min–170 min.
→Add the numbers.
→Use the basic percent equation.

Solution Number of runners with times between:
150 min–155 min: 5
155 min–160 min: 10
160 min–165 min: 25
165 min–170 min: 30
$5 + 10 + 25 + 30 = 70$
Percent · base = amount
$p(100) = 70$
$p = \frac{70}{100} = 0.70$
70% of the runners had times less than 170 min.

31. Strategy To find the percent:
→Read the histogram to find the number of apartments with rents between \$550 and \$650.
→Use the basic percent equation.

Solution Number of apartments with rents between \$550 and \$650: 5
Percent · base = amount
$p(40) = 5$
$p = \frac{5}{40} = 0.125$
12.5% of the apartments have rents between \$550 and \$650.

32. Strategy To find the percent:
→Read the histogram to find the number of apartments with rents between \$250 and \$350.
→Use the basic percent equation.

Solution Number of apartments with rents between \$250 and \$350: 6
Percent · base = amount
$p(40) = 6$
$p = \frac{6}{40} = 0.15$
15% of the apartments have rents between \$250 and \$350.

33. Strategy

To find the percent:
→Read the histogram to find the number of apartments with rents between \$450–\$550, \$550–\$650, and \$650–\$750.
→Add the numbers.
→Use the basic percent equation.

Solution

Number of apartments with rents between:
\$450–\$550: 15
\$550–\$650: 5
\$650–\$750: 2
$15 + 5 + 2 = 22$
Percent · base = amount
$p(40) = 22$
$p = \frac{22}{40} = 0.55$
55% of the apartments have rents over \$450.

34. Strategy

To find the percent:
→Read the histogram to find the number of apartments with rents between \$250–\$350, \$350–\$450, and \$450–550.
→Add the numbers.
→Use the basic percent equation.

Solution

Number of apartments with rents between:
\$250–\$350: 6
\$350–\$450: 12
\$450–\$550: 15
$6 + 12 + 15 = 33$
Percent · base = amount
$p(40) = 33$
$p = \frac{33}{40} = 0.825$
82.5% of the apartments have rents less than \$550.

Objective C Exercises, page 592

35. Strategy

To find the number of nurses:
→Read the frequency polygon to find the number of nurses whose score was between 80–90 and between 90–100.
→Add the numbers.

Solution

Number of nurses whose score was between:
80–90: 18
90-100: 4
$18 + 4 = 22$
22 of the nurses had scores greater than 80.

36. Strategy To find the number of nurses:

→Read the frequency polygon to find the number of nurses whose score was between 50–60 and between 60–70.

→Add the numbers.

Solution Number of nurses whose score was between:

50–60: 5

60–70: 8

$5 + 8 = 13$

13 of the nurses had scores less than 70.

37. Strategy To find the percent:

→Read the frequency polygon to find the number of nurses whose score was between 70–80 and between 80–90.

→Add the numbers.

→Use the basic percent equation.

Solution Number of nurses whose score was between:

70–80: 15

80–90: 18

$15 + 18 = 33$

Percent · base = amount

$p(50) = 33$

$p = \frac{33}{50} = 0.66$

66% of the nurses had scores between 70 and 90.

38. Strategy To find the percent:

→Read the frequency polygon to find the number of nurses who scored between 70–80, between 80–90, and between 90–100.

→Add the numbers.

→Use the basic percent equation.

Solution Number of nurses whose score was between:

70–80: 15

80–90: 18

90–100: 4

$15 + 18 + 4 = 37$

Percent · base = amount

$p(50) = 37$

$p = \frac{37}{50} = 0.74$

74% of the nurses had scores over 70.

39. Strategy To find the ratio:

→Read the frequency polygon to find the response times between 6 min and 9 min and between 15 min and 18 min.

→Write the ratio in simplest form.

Solution Number of response times between:

6 min–9 min: 18

15 min–18 min: 3

$$\frac{\text{response times between } 6-9 \text{ min}}{\text{response times between } 15-18 \text{ min}} = \frac{18}{3} = \frac{6}{1}$$

The ratio is $\frac{6}{1}$.

40. Strategy To find the ratio:
→Read the frequency polygon to find the response time between 0 min and 3 min and the total number of recorded response times (75).
→Write the ratio in simplest form.

Solution Number of response times between 0 min and 3 min: 5.

$$\frac{\text{reponse time between } 0-3 \text{ min}}{\text{total response times}} = \frac{5}{75} = \frac{1}{15}$$

The ratio is $\frac{1}{15}$.

41. Strategy To find the percent:
→Read the frequency polygon to find the response time between 9 min and 12 min, between 12 min and 15 min, and between 15 min and 18 min.
→Add the numbers.
→Use the basic percent equation.

Solution Number of response times between:
9 min–12 min: 20
12 min–15 min: 17
15 min–18 min: 3
$20 + 17 + 3 = 40$
Percent · base = amount
$p(75) = 40$
$p = \frac{40}{75}$
$p \approx 0.533$
Approximately 53.3% of the response times are greater than 9 min.

42. Strategy To find the percent:
→Read the frequency polygon to find the response time between 0 min and 3 min, between 3 min and 6 min, and between 9 min and 12 min.
→Add the numbers.
→Use the basic percent equation.

Solution Number of response times between:
0 min–3 min: 5
3 min–6 min: 12
6 min–9 min: 18
9 min–12 min: 20
$5 + 12 + 18 + 20 = 55$
Percent · base = amount
$p(75) = 55$
$p = \frac{55}{75}$
$p \approx 0.733$
Approximately 73.3% of the response times are less than 12 min.

Critical Thinking 10.1, page 592

43. Answers will vary.

44. Answers will vary.

Section 10.2

Objective A Exercises, pages 599–600

3. Strategy

To find the mean number of televisions sold per month:
→Determine the sum of the numbers sold.
→Divide the sum by 12.
To find the median number of seats occupied:
→Arrange the numbers from smallest to largest.
→Because there is an even number of values, the median is the sum of the two middle numbers divided by 2.

Solution

The sum of the numbers is 228.

$\bar{x} = \frac{228}{12} = 19$

The mean number of televisions is 19.

12 15 15 17 17 19
20 20 20 22 24 27

$\text{median} = \frac{19+20}{2} = 19.5$

The median is 19.5 units.

4. Strategy

To find the mean number of occupied seats:
→Determine the sum of the occupied seats
→Divide the sum by 16.
To find the median number of seats occupied:
→Arrange the numbers from smallest to largest.
→Because there is an even number of values, the median is the sum of the two middle numbers divided by 2.

Solution

The sum of the numbers is 6,105.

$\bar{x} = \frac{6{,}105}{16} = 381.5625$

The mean number of occupied seats is 381.5625.

309 319 330 352 367 387 389 391
398 399 401 408 410 411 412 422

$\text{median} = \frac{391+398}{2} = 394.5$

The median is 394.5 units.

5. Strategy

To find the mean of the times of the 100-meter dash:
→Determine the sum of the times.
→Divide the sum by 10.
To find the median time for the 100-meter dash:
→Arrange the numbers from smallest to largest.
→Because there is an even number of values, the median is the sum of the two middle numbers divided by 2.

Solution

The sum of the numbers is 106.10.

$\bar{x} = \frac{106.10}{10} = 10.61$

The mean time for the 100–meter dash is 10.61 s.

10.23 10.26 10.45 10.52 10.57
10.64 10.74 10.78 10.90 11.01

$\text{median} = \frac{10.57+10.64}{2} = 10.605$

The median time for the 100–meter dash is 10.605 s.

6. Strategy To find the mean of the cost of the items:
→Determine the sum of the costs.
→Divide the sum by 8.
To find the median cost of the items:
→Arrange the numbers from smallest to largest.
→Because there is an even number of values, the median is the sum of the two middle numbers divided by 2.

Solution The sum of the numbers is 364.92.

$\bar{x} = \frac{364.92}{8} = 45.615$

The mean cost of the items is \$45.615.

40.67	41.43	42.45	45.82
45.89	47.81	48.73	51.12

$\text{median} = \frac{45.82 + 45.89}{2} = 45.855$

The median cost of the items is \$45.855.

7. Strategy To find the mean score:
→Determine the sum of the numbers.
→Divide the sum by 6.
To find the median score:
→Arrange the numbers from smallest to largest.
→The median is the middle term.

Solution The sum of the numbers is 524.

$\bar{x} = \frac{524}{6} \approx 87.33$

The mean is approximately 87.33.

77	78	88
92	94	95

$\text{median} = \frac{88 + 92}{2} = 90$

The mean score is 87.33 and the median score is 90. The instructor using the mean score would give the student a B. Using the median, the instructor would give the student an A.

8. Strategy To find the mean monthly rate:
→Determine the sum of the numbers.
→Divide the sum by 8.
To find the median monthly rate:
→Arrange the numbers from smallest to largest.
→Because there is an even number of values, the median is the sum of the two middle numbers divided by 2.

Solution The sum of the numbers is 3,229.

$\bar{x} = \frac{3{,}229}{8} = 403.625$

The mean monthly rate is \$403.625.

355	390	396	404
405	423	426	430

$\text{median} = \frac{404 + 405}{2} = 404.5$

The median monthly rate is \$404.50.

9. Strategy To find the number of yards to be gained:
→Let n represent the number of yards to be gained.
→Use the formula for the mean to solve for n.

Solution $100 = \frac{98+105+120+90+111+104+n}{7}$
$700 = 628 + n$
$72 = n$
The running back must gain 72 yd.

10. Strategy To find the number of unforced errors:
→Let n represent the number of unforced errors in the fifth set.
→Use the formula for the mean to solve for n.

Solution $20 = \frac{15+22+24+18+n}{5}$
$100 = 79 + n$
$21 = n$

11. Strategy To find the score:
→Let n represent the score on the sixth round.
→Use the formula for the mean to solve for n.

Solution $78 = \frac{78+82+75+77+79+n}{6}$
$468 = 391 + n$
$77 = n$
The score must be 77 on the sixth round.

12. Strategy To find the modal response, write down the category that received the most responses.

Solution Because a response of German chocolate cake was recorded most frequently, the modal response was German chocolate cake.

13. Strategy To find the modal response, write down the category that received the most responses.

Solution Because a response of brown was recorded most frequently, the modal response was brown.

14. Strategy To find the modal response, write down the category that received the most responses.

Solution Because a response of satisfactory was recorded most frequently, the modal response was satisfactory.

15. Strategy To find the modal response, write down the category that received the most responses.

Solution Because a response of very good was recorded most frequently, the modal response was very good.

Objective B Exercises, pages 600–601

16. Strategy

To find the youngest age in the set of data, look at the smallest value of the box-and-whisker plot.
To find the oldest age in the set of data, look at the largest value of the box-and-whisker plot.
To find the median, look at the median of the box-and-whisker plot.
To find the range, subtract the smallest value from the largest value.

Solution

The youngest age is 42. The oldest age is 69. The median is 55.
$69 - 42 = 27$
The range is 27.

17. Strategy

To draw the box-and-whiskers plot:
→Arrange the data from smallest to largest, and then find the median.
→Find Q_1, the median of the lower half of the data.
→Find Q_3, the median of the upper half of the data.
→Determine the smallest and largest data values.
→Draw the box-and-whiskers plot.

Solution

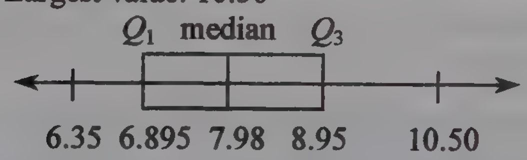
6.35 6.45 6.46 6.70 7.09 7.12 7.64 7.94
8.02 8.03 8.31 8.85 9.05 9.35 10.40 10.50

$$\text{median} = \frac{7.94 + 8.02}{2} = 7.98$$

$$Q_1 = \frac{6.70 + 7.09}{2} = 6.895$$

$$Q_3 = \frac{8.85 + 9.05}{2} = 8.95$$

Smallest value: 6.35
Largest value: 10.50



18. Strategy

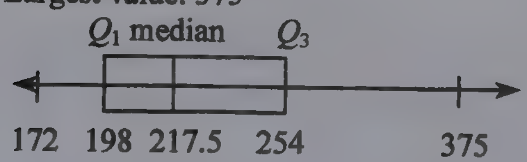
To draw the box-and-whiskers plot:
→Arrange the data from smallest to largest, and then find the median.
→Find Q_1, the median of the lower half of the data.
→Find Q_3, the median of the upper half of the data.
→Determine the smallest and largest data values.
→Draw the box-and-whiskers plot.

Solution

172 183 185 198 208 211 214
221 233 251 254 258 292 375

$$\text{median} = \frac{214 + 221}{2} = 217.5$$

$Q_1 = 198$
$Q_3 = 254$
Smallest value: 172
Largest value: 375



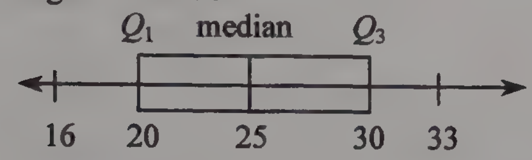
19. Strategy

To draw the box-whiskers plot:
→Arrange the data from smallest to largest, and then find the median.
→Find Q_1, the median of the lower half of the data.
→Find Q_3, the median of the upper half of the data.
→Determine the smallest and largest data values.
→Draw the box-and-whiskers plot.

Solution

16 17 19 20 20 21 21 22 24 25
26 26 28 30 30 31 31 32 33

median = 25
$Q_1 = 20$
$Q_3 = 30$
Smallest value: 16
Largest value: 33



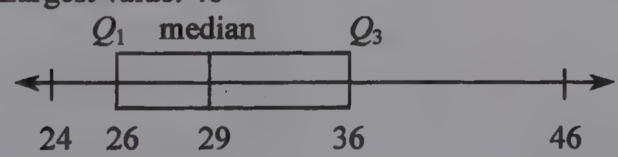
20. Strategy

To draw the box-and-whiskers plot:
→Arrange the data from smallest to largest, and then find the median.
→Find Q_1, the median of the lower half of the data.
→Find Q_3, the median of the upper half of the data.
→Determine the smallest and largest data values.
→Draw the box-and-whiskers plot.

Solution

24 24 25 26 26 27 28 28 29
30 34 34 35 37 42 43 46

median = 29
$Q_1 = \frac{26+26}{2} = 26$
$Q_3 = \frac{35+37}{2} = 36$
Smallest value: 24
Largest value: 46



21. Strategy

To draw the box-and-whiskers plot:
→Arrange the data from smallest to largest, and then find the median.
→Find Q_1, the median of the lower half of the data.
→Find Q_3, the median of the upper half of the data.
→Determine the smallest and largest data values.
→Draw the box-and-whiskers plot.

Solution

2.6 3.1 3.5 4.3 4.3 4.8 4.9 5.1
5.3 5.3 5.4 6.0 6.2 6.7 6.8 8.0

median $\frac{5.1+5.3}{2} = 5.2$

$Q_1 = \frac{4.3+4.3}{2} = 4.3$

$Q_3 = \frac{6.0+6.2}{2} = 6.1$

Smallest value: 2.6
Largest value: 8.0

Q_1 median Q_3

2.6 4.3 5.2 6.1 8.0

22. Strategy

To draw the box-and-whiskers plot:
→Arrange the data from smallest to largest, and then find the median.
→Find Q_1, the median of the lower half of the data.
→Find Q_3, the median of the upper half of the data.
→Determine the smallest and largest data values.
→Draw the box-and-whiskers plot.

Solution

789 890 905 986 992 998 1010 1020 1050 1100
1106 1180 1200 1235 1268 1298 1309 1381 1390 1400

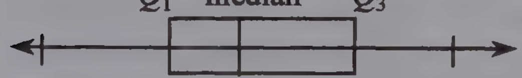
median $= \frac{1100+1106}{2} = 1103$

$Q_1 = \frac{992+998}{2} = 995$

$Q_3 = \frac{1268+1298}{2} = 1283$

Smallest value: 789
Largest value: 1400

Q_1 median Q_3



789 995 1103 1283 1400

Objective C Exercises, pages 601–602

23. Strategy To calculate the standard deviation:
→Find the mean of the times.
→Use the procedure for calculating standard deviation.

Solution $\bar{x} = \dfrac{12+18+20+14+16}{5} = 16$

x	$(x-\bar{x})^2$	
12	$(12-16)^2$	16
18	$(18-16)^2$	4
20	$(20-16)^2$	16
14	$(14-16)^2$	4
16	$(16-16)^2$	0
	Total	= 40

$\dfrac{40}{5} = 8$

$\sigma = \sqrt{8} \approx 2.828$

The standard deviation of the times is approximately 2.828.

24. Strategy To calculate the standard deviation:
→Find the mean of the weights.
→Use the procedure for calculating standard deviation.

Solution $\bar{x} = \dfrac{96+105+84+90+102+99}{6} = 96$

x	$(x-\bar{x})^2$	
96	$(96-96)^2$	0
105	$(105-96)^2$	81
84	$(84-96)^2$	144
90	$(90-96)^2$	36
102	$(102-96)^2$	36
99	$(99-96)^2$	9
	Total	= 306

$\dfrac{306}{6} = 51$

$\sigma = \sqrt{51} \approx 7.141$

The standard deviation of the weights is approximately 7.141.

25. Strategy To calculate the standard deviation:
→Find the mean number of rooms.
→Use the procedure for calculating standard deviation.

Solution $\bar{x} = \frac{234+321+222+246+312+396}{6} = \frac{1,731}{6} = 288.5$

x	$(x-\bar{x})^2$	
234	$(234-288.5)^2$	2,970.25
321	$(321-2.885)^2$	1,056.25
222	$(222-288.5)^2$	4,422.25
246	$(246-288.5)^2$	1,806.25
312	$(312-288.5)^2$	552.25
396	$(396-288.5)^2$	11,556.25
	Total	= 22,363.5

$\frac{22,363.5}{6} \approx 3,727.25$

$\alpha = \sqrt{3,727.25} \approx 61.05$

The standard deviation of the number of rooms is approximately 61.05.

26. Strategy To calculate the standard deviation:
→Find the mean number of heads.
→Use the procedure for calculating standard deviation.

Solution $\bar{x} = \frac{56+63+49+50+48+53+52}{7} = \frac{371}{7} = 53$

x	$(x-\bar{x})^2$	
56	$(56-53)^2$	9
63	$(63-53)^2$	100
49	$(49-53)^2$	16
50	$(50-53)^2$	9
48	$(48-53)^2$	25
53	$(53-53)^2$	0
52	$(52-53)^2$	1
	Total	= 160

$\frac{160}{7} \approx 22.857$

$\sigma = \sqrt{22.857} \approx 4.781$

The standard deviation of the number of heads is approximately 4.781.

27. Strategy To determine the place of the greater standard deviation of temperatures:
→Find the amount of the temperatures from the two places.
→Use the procedure for calculating standard deviation.
→Compare the answers and write the larger standard deviation.

Solution For the desert resort:

$$\bar{x} = \frac{95+98+98+104+97+100+96+97+108+93+104}{11}$$

$$\bar{x} = \frac{1090}{11} \approx 99.091$$

x	$(x-\bar{x})^2$	
95	$(95-99.091)^2$	16.7363
98	$(98-99.091)^2$	1.1903
98	$(98-99.091)^2$	1.1903
104	$(104-99.091)^2$	24.0983
97	$(7-99.091)^2$	4.3723
100	$(100-99.091)^2$	0.8263
96	$(96-99.091)^2$	9.5543
97	$(97-99.091)^2$	4.3723
108	$(108-99.091)^2$	79,3703
98	$(93-99.091)^2$	37.1003
104	$(104-99.091)^2$	24,0983
	Total	= 202.9093

$$\frac{202.9093}{11} \approx 18.4463$$

$$\sigma = \sqrt{18.4463} \approx 4.295$$

For the Antarctic:

$$\bar{x} = \frac{27+28+28+30+28+27+30+25+24+26+21}{11}$$

$$\bar{x} = \frac{294}{11} \approx 26.727$$

x	$(x-\bar{x})^2$	
27	$(27-26.727)^2$	0.0745
28	$(28-26.727)^2$	1.6205
28	$(28-26.727)^2$	1.6205
30	$(30-26.727)^2$	10.7125
28	$(28-26.727)^2$	1.6205
27	$(27-26.727)^2$	0.0745
30	$(30-26.727)^2$	10.7125
25	$(25-26.727)^2$	2.9825
24	$(24-26.727)^2$	7.4365
26	$(26-26.727)^2$	0.5285
21	$(21-26.727)^2$	32.7985

Total $= 70.1815$

$\frac{70.1815}{11} \approx 6.3801$

$\sigma = \sqrt{6.3801} \approx 2.526$

The standard deviation of the temperature is greater at the desert resort.

28. Strategy To determine which basketball team has the greater standard deviation of scores:

→Find the means of the two sets of scores.

→Use the procedure for calculating standard deviation.

→Compare the answers and write the larger standard deviation.

Solution $\bar{x} = \frac{56+68+60+72+64}{5} = \frac{320}{5} = 64$

x	$(x-\bar{x})^2$	
56	$(56-64)^2$	64
68	$(68-64)^2$	16
60	$(60-64)^2$	16
72	$(72-64)^2$	64
64	$(64-64)^2$	0
	Total	$= 160$

$\frac{160}{5} = 32$

$\sigma = \sqrt{32} = 5.657$

$\bar{x} = \frac{106+118+110+122+114}{5} = \frac{570}{5} = 114$

x	$(x-\bar{x})^2$	
106	$(106-114)^2$	64
118	$(118-114)^2$	16
110	$(110-114)^2$	16
122	$(122-114)^2$	64
114	$(114-114)^2$	0
	Total	$= 160$

$\frac{160}{5} = 32$

$\sigma = \sqrt{32} = 5.657$

The standard deviations are the same.

Critical Thinking 10.2, page 602

29. $\bar{x}_1 = \dfrac{85+92+86+89}{4} = \dfrac{352}{4} = 88$

$\bar{x}_2 = \dfrac{90+97+91+94}{4} = \dfrac{372}{4} = 93$

The mean scores of the two students are not the same.
The mean score of the second student is 5 points higher.

Student 1:

x	$(x-\bar{x})^2$	
85	$(85-88)^2$	9
92	$(92-88)^2$	16
86	$(86-88)^2$	4
89	$(89-88)^2$	1
	Total	= 30

$\frac{30}{4} = 7.5$

$\sigma_1 = \sqrt{7.5} \approx 2.74$

Student 2:

x	$(x-\bar{x})^2$	
90	$(90-93)^2$	9
97	$(97-93)^2$	16
91	$(91-93)^2$	4
94	$(94-93)^2$	1
	Total	= 30

$\frac{30}{4} = 7.5$

$\sigma_2 = \sqrt{7.5} = 2.74$

Yes. The standard deviations of the two sets of scores are the same.

30. a. Always true. If the data contain an odd number of values, once arranged from smallest to largest, the median is the middle number of the data set.

b. Sometimes true. If the data contain an even number of values, the median is the sum of the two middle numbers divided by 2. If the two middle numbers are the same, then the median *is* one of the numbers in the set. If the two middle numbers are *not* the same, then the median is not one of the numbers in the set.

c. Sometimes true. If the data set consists of all the same number, then the median is *not* less than the highest number in the set. It is equal to the highest number in the set. If the data set consists of all different numbers, then the median is less than the highest number in the set.

31. Answers will vary; for example, 10, 14, 14, 14, 16, 18, 19, 23.

Section 10.3

Objective A Exercises, pages 609–611

3. Possible outcomes of tossing 4 coins:

Q_1	Q_2	Q_3	Q_4
H	H	H	H
H	H	H	T
H	H	T	H
H	T	H	H
T	H	H	H
H	H	T	T
H	T	T	H
T	T	H	H
H	T	H	T
T	H	T	H
T	H	H	T
H	T	T	T
T	T	T	H
T	T	H	T
T	H	T	T
T	T	T	T

4. Possible outcomes of having three colors:

Q_1	Q_2	Q_3
R	G	B
R	B	G
G	R	B
G	B	R
B	R	G
B	G	R

5. Possible outcomes from tossing two tetrahedral die:

(1, 1)	(2, 1)	(3, 1)	(4, 1)
(1, 2)	(2, 2)	(3, 2)	(4, 2)
(1, 3)	(2, 3)	(3, 3)	(4, 3)
(1, 4)	(2, 4)	(3, 4)	(4, 4)

6. Possible outcomes of tossing a coin and then a die:

(H, 1)	(T, 1)
(H, 2)	(T, 2)
(H, 3)	(T, 3)
(H, 4)	(T, 4)
(H, 5)	(T, 5)
(H, 6)	(T, 6)

7. No, because the dice are weighted so that some numbers occur more often than other numbers.

8. No, because some areas are larger than others, some numbers will occur more often than other numbers.

9. Strategy To find the probability:
→Refer to Exercise 3 to count the number of possible outcomes of the experiment.
→Count the outcomes of the experiment that are favorable to the event HHTT.
→Use the probability formula.

Solution There are 16 possible outcomes.
There is 1 outcome favorable to E.
$P(E)=\frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$ $P(E)=\frac{1}{16}$
The probability of HHTT is $\frac{1}{16}$.

10. Strategy To find the probability:
→Refer to Exercise 3 to count the number of possible outcomes of the experiment.
→Count the outcomes of the experiment that are favorable to the event HTTH.
→Use the probability formula.

Solution There are 16 possible outcomes.
There is 1 outcome favorable to E.
$P(E)=\frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$ $P(E)=\frac{1}{16}$
The probability of HTTH is $\frac{1}{16}$.

11. Strategy To find the probability:
→Refer to Exercise 3 to count the number of possible outcomes of the experiment.
→Count the outcomes of the experiment that are favorable to the event.
→Use the probability formula.

Solution There are 16 possible outcomes.
There are 6 outcomes favorable to E: HHTT, HTTH, TTHH, HTHT, THTH, THHT
$P(E)=\frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$
$P(E)=\frac{1}{16}=\frac{3}{8}$
The probability of the event is $\frac{3}{8}$.

12. Strategy To find the probability:

→Refer to Exercise 3 to count the number of possible outcomes of the experiment.

→Count the outcomes of the experiment that are favorable to the event.

→Use the probability formula.

Solution There are 16 possible outcomes.

There are 4 outcomes favorable to E: HTTT, TTTH, TTHT, THTT

$$P(E) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$$

$$P(E) = \frac{4}{16} = \frac{1}{4}$$

The probability of the event is $\frac{1}{4}$.

13. Strategy To find the probability:

→Refer to the table on page 606 to count the number of possible outcomes of the experiment.

→Count the outcomes of the experiment that are favorable to the event the sum is 5.

→Use the probability formula.

Solution There are 36 possible outcomes.

There are 4 outcomes favorable to E: (1, 4), (2, 3), (3, 2), (4, 1)

$$P(E) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$$

$$P(E) = \frac{4}{36} = \frac{1}{9}$$

The probability that the sum is 5 is $\frac{1}{9}$.

14. Strategy To find the probability:

→Refer to the table on page 606 to count the number of possible outcomes of the experiment.

→Count the outcomes of the experiment that are favorable to the event the sum is 9.

→Use the probability formula.

Solution There are 36 possible outcomes.

There are 4 outcomes favorable to E: (3, 6), (4, 5), (5, 4), (6, 3)

$$P(E) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$$

$$P(E) = \frac{4}{36} = \frac{1}{9}$$

The probability that the sum is 9 is $\frac{1}{9}$.

15. Strategy To find the probability:

→Refer to the table on page 606 to count the number of possible outcomes of the experiment.

→Count the outcomes of the experiment that are favorable to the event the sum is 15.

→Use the probability formula.

Solution There are 36 possible outcomes.

$$P(E) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$$

$$P(E) = \frac{0}{36} = 0$$

The probability that the sum is 15 is 0.

16. Strategy To find the probability:
→Refer to the table on page 606 to count the number of possible outcomes of the experiment.
→Count the outcomes of the experiment that are favorable to the event the sum is less than 15.
→Use the probability formula.

Solution There are 36 possible outcomes.
There are 36 outcomes favorable to E.

$$P(E) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$$

$$P(E) = \frac{36}{36} = 1$$

The probability that the sum is less than 15 is 1.

17. Strategy To find the probability:
→Refer to the table on page 606 to count the number of possible outcomes of the experiment.
→Count the outcomes of the experiment that are favorable to the event the sum is 2.
→Use the probability formula.

Solution There are 36 possible outcomes.
There is 1 outcome favorable to E: (1, 1)

$$P(E) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$$

$$P(E) = \frac{1}{36}$$

The probability that the sum is 2 is $\frac{1}{36}$.

18. Strategy To find the probability:
→Refer to the table on page 606 to count the number of possible outcomes of the experiment.
→Count the outcomes of the experiment that are favorable to the event the sum is 12.
→Use the probability formula.

Solution There are 36 possible outcomes.
There is 1 outcome favorable to E: (6, 6)

$$P(E) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$$

$$P(E) = \frac{1}{36}$$

The probability that the sum is 12 is $\frac{1}{36}$.

19. Strategy

To find the probability:
→Count the number of possible outcomes of the experiment.
→Count the outcomes of the experiment that produce an 11.
→Use the probability formula.

Solution

A dodecahedral die has 12 sides.
There is 1 outcome favorable to E: 11

$$P(E) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$$

$$P(E) = \frac{1}{12}$$

The probability that the number is 11 is $\frac{1}{12}$.

20. Strategy

To find the probability:
→Count the number of possible outcomes of the experiment.
→Count the outcomes of the experiment that produce a 5.
→Use the probability formula.

Solution

A dodecahedral die has 12 sides.
There is 1 outcome favorable to E: 5

$$P(E) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$$

$$P(E) = \frac{1}{12}$$

The probability that the number is 5 is $\frac{1}{12}$.

21. Strategy

To find the probability:
→Refer to Exercise 5 to count the number of possible outcomes of the experiment.
→Count the outcomes of the experiment that are favorable to the event the sum is 4.
→Use the probability formula.

Solution

There are 16 possible outcomes.
There are 3 outcomes favorable to E: (1, 3), (2, 2), (3,1)

$$P(E) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$$

$$P(E) = \frac{3}{16}$$

The probability that the sum is 4 is $\frac{3}{16}$.

22. Strategy

To find the probability:
→Refer to Exercise 5 to count the number of possible outcomes of the experiment.
→Count the outcomes of the experiment that are favorable to the event the sum is 6.
→Use the probability formula.

Solution

There are 16 possible outcomes.
There are 3 outcomes favorable to E: (2, 4), (3, 3), (4, 2)

$$P(E) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$$

$$P(E) = \frac{3}{16}$$

The probability that the sum is 6 is $\frac{3}{16}$.

23. Strategy

To find the probability:
→Count the number of possible outcomes of the experiment.
→Count the outcomes of the experiment that produce a number divisible by 4.
→Use the probability formula.

Solution

A dodecahedral die has 12 sides.
There are 3 outcomes favorable to E: 4, 8, 12

$$P(E)=\frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$$

$$P(E)=\frac{3}{12}=\frac{1}{4}$$

The probability that the side is divisible by 4 is $\frac{1}{4}$.

24. Strategy

To find the probability:
→Count the number of possible outcomes of the experiment.
→Count the outcomes of the experiment that produce a number that is a multiple of 3.
→Use the probability formula.

Solution

A dodecahedral die has 12 sides.
There are 4 outcomes favorable to E: 3, 6, 9, 12

$$P(E)=\frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$$

$$P(E)=\frac{4}{12}=\frac{1}{3}$$

The probability that the side is a multiple of 3 is $\frac{1}{3}$.

25. Strategy

To find the empirical probability, use the probability formula and divide the number of observations of E (37) by the total number of observations (95).

Solution

$$P(E)=\frac{\text{number of observations of } E}{\text{total number of observations}}$$

$$P(E)=\frac{37}{95}$$

The probability is $\frac{37}{95}$ that a person prefers a cash discount.

26. Strategy

To find the empirical probability, use the probability formula and divide the number of observations of E (587) by the total number of observations (725).

Solution

$$P(E)=\frac{\text{number of observations of } E}{\text{total number of observations}}$$

$$P(E)=\frac{587}{725}$$

The probability is $\frac{587}{725}$ that an employee has a group health insurance plan.

27. Strategy To find the probability:

→Count the number of possible outcomes of the experiment.

→Count the number of outcomes of the experiment favorable to the event E, the light is green.

→Use the probability formula.

Solution There are $5\frac{1}{4}\left(3+\frac{1}{4}+2\right)$ min for the lights to proceed through a complete cycle.

The green light lasts for a duration of 3 min.

$$P(E)=\frac{3}{5\frac{1}{4}}=\frac{3}{\frac{21}{4}}=3\div\frac{21}{4}=\frac{3}{1}\cdot\frac{4}{21}=\frac{4}{7}$$

The probability of having a green light is $\frac{4}{7}$.

28. Strategy To find the probability:

→Count the number of possible outcomes of the experiment.

→Count the number of outcomes of the experiment favorable to the event E, the paper chosen rates a B.

→Use the probability formula.

Solution There are $47(4+8+22+10+3)$ papers that received grades.

8 papers received a B grade.

$$P(E)=\frac{8}{47}$$

The probability is $\frac{8}{47}$ that the paper has a B grade.

29. Strategy To find the probability:

→Count the number of possible outcomes of the experiment.

→Count the number of outcomes of the experiment favorable to the event E, the service is satisfactory or excellent.

→Use the probability formula.

Solution There are $377(98+87+129+42+21)$ outcomes of the survey.

There are $185(98+87)$ outcomes favorable to E.

$$P(E)=\frac{185}{377}$$

The probability is $\frac{185}{377}$ that the cable service is rated satisfactory or excellent.

30. Strategy To find the probability:

→Count the number of possible outcomes of the experiment.

→Count the number of outcomes of the experiment favorable to the event E, the service is unsatisfactory or poor.

→Use the probability formula.

Solution There are $377(98+87+129+42+21)$ outcomes of the survey.

There are $63(42+21)$ outcomes favorable to E.

$$P(E)=\frac{63}{377}$$

The probability is $\frac{63}{377}$ that the cable service is rated unsatisfactory or poor.

Objective B Exercises, pages 611–612

31. Strategy To find the odds:
→Count the favorable outcomes.
→Count the unfavorable outcomes.
→Use the odds in favor of an event formula.

Solution Number of favorable outcomes: 1
Number of unfavorable outcomes: 1

$$\text{Odds in favor} = \frac{\text{number of favorable outcomes}}{\text{number of unfavorable outcomes}}$$

$$\text{Odds in favor} = \frac{1}{1}$$

The odds of showing heads is 1 TO 1.

32. Strategy To find the odds:
→Count the favorable outcomes.
→Count the unfavorable outcomes.
→Use the odds in favor of an event formula.

Solution There is 1 favorable outcomes: TT
There are 3 unfavorable outcomes: TH, HT, HH

$$\text{Odds in favor} = \frac{\text{number of favorable outcomes}}{\text{number of unfavorable outcomes}}$$

$$\text{Odds in favor} = \frac{1}{3}$$

The odds of showing two tails is 1 TO 3.

33. Strategy To calculate the probability of winning:
→Restate the odds against as odds in favor.
→Using the odds in favor fraction, the probability of winning is the ratio of the numerator to the sum of the numerator and denominator.

Solution The odds against winning are 40 TO 1. Therefore, the odds in favor of winning are 1 TO 40.

$$\text{Probability of winning: } \frac{1}{1+40} = \frac{1}{41}$$

The probability of winning the Super Bowl is $\frac{1}{41}$.

34. Strategy To calculate the probability of winning:
→Restate the odds against as odds in favor.
→Using the odds in favor fraction, the probability of winning is the ratio of the numerator to the sum of the numerator and denominator.

Solution The odds against winning are 25 TO 1. Therefore, the odds in favor of winning are 1 TO 25.

$$\text{Probability of winning} = \frac{1}{1+25} = \frac{1}{26}$$

The probability of winning the World Series is $\frac{1}{26}$.

35. Strategy To find the odds:
→Count the favorable outcomes of the experiment.
→Count the unfavorable outcomes of the experiment.
→Use the formula for the odds in favor of an event.

Solution Use the table on page 606 to:
Count the favorable outcomes: 6
Count the unfavorable outcomes: 30
Odds in favor $= \frac{6}{30} = \frac{1}{5}$
The odds in favor of rolling a 7 are $\frac{1}{5}$.

36. Strategy To find the odds:
→Count the favorable outcomes of the experiment.
→Count the unfavorable outcomes of the experiment.
→Use the formula for the odds in favor of an event.

Solution Use the table on page 606 to:
Count the favorable outcomes: 1
Count the unfavorable outcomes: 35
Odds in favor $= \frac{1}{35}$
The odds in favor of rolling a 12 are $\frac{1}{35}$.

37. Strategy To find the odds:
→Determine the unfavorable outcomes.
→Determine the favorable outcomes.
→Use the formula for the odds against an event.

Solution There are 48 ways of not picking an ace.
There are 4 way of picking an ace.
Odds against $= \frac{48}{4} = \frac{12}{1}$
The odds against picking an ace are $\frac{12}{1}$.

38. Strategy To find the odd:
→Determine the unfavorable outcomes.
→Determine the favorable outcomes.
→Use the formula for the odds against an event.

Solution There are 39 ways of not picking a heart.
There are 13 ways of picking a heart.
Odds against $= \frac{39}{13} = \frac{3}{1}$
The odds against picking a heart are $\frac{3}{1}$.

39. Strategy To calculate the probability of winning, use the odds in favor fraction. The probability of winning is the ratio of the numerator to the sum of the numerator and denominator.

Solution Probability of winning
$= \frac{3}{3+2} = \frac{3}{5}$
The probability of winning the election is $\frac{3}{5}$.

40. Strategy To calculate the probability of winning, use the odds in favor fraction. The probability of winning is the ratio of the numerator to the sum of the numerator and denominator.

Solution Probability of winning
$= \frac{3}{3+7} = \frac{3}{10}$
The probability of winning the board game is $\frac{3}{10}$.

41. Strategy To calculate the probability of the stock going down:
→Restate the odds of the stock going up as the odds of the stock going down.
→Using the odds in favor of the stock going down, the probability of going down is the ratio of the numerator to the sum of the numerator and denominator.

Solution The odds in favor of the stock going up: 2 TO 1
The odds in favor of the stock going down: 1 TO 2
Probability of going down:
$= \frac{1}{1+2} = \frac{1}{3}$
The probability of the stock going down is $\frac{1}{3}$.

42. Strategy To find the greater probability of occurring:
→Find the probability of event A occurring.
→Find the probability of event B occurring.
→Compare the probability of event A and probability of event B.

Solution Probability of event
$A = \frac{5}{5+2} = \frac{5}{7}$
Odds in favor of event B:
7 TO 1
Probability of event
$B = \frac{7}{7+1} = \frac{7}{8}$
$\frac{5}{7} = \frac{40}{56}$ $\frac{7}{8} = \frac{49}{56}$
$\frac{40}{56} < \frac{49}{56}$
$\frac{5}{7} < \frac{7}{8}$
Event B has the greater probability of occurring.

Critical Thinking 10.3, page 612

43. The sum of the probabilities that a ball is chosen is 1.
$\frac{1}{2} + \frac{1}{3} + \frac{1}{9} = \frac{18}{36} + \frac{12}{36} + \frac{4}{36} = \frac{34}{36}$. The sum of the probabilities is not 1.

44. In a triangle the sum of any two sides must be larger than the third side.

Triangle with sides	Form a triangle
1 cm, 2 cm, 3 cm	no
1 cm, 2 cm, 4 cm	no
1 cm, 2 cm, 5 cm	no
1 cm, 3 cm, 4 cm	no
1 cm, 3 cm, 5 cm	no
1 cm, 4 cm, 5 cm	no
2 cm, 3 cm, 4 cm	yes
2 cm, 3 cm, 5 cm	no
2 cm, 4 cm, 5 cm	yes
3 cm, 4 cm, 5 cm	yes

3 events favorable, 7 events unfavorable
Probability of the event $= \frac{3}{3+7} = \frac{3}{10}$.

Chapter Review Exercises, pages 617–618

1. Strategy To prepare the frequency distribution table, use 7 as the class width and 12 as the lower class boundary.

Solution Number of Students in Math Classes

Classes	Tally	Frequency
12–19	/////	5
20–27	/////////	9
28–35	///////////	11
36–43	/////////	9
44–51	////	4
52–59	//	2

2. Strategy To find the class with the greatest frequency, refer to the frequency table in Exercise 1.

Solution The class with the greatest frequency is 28–35.

3. Strategy To find the number of classes:
→Use Exercise 1 to find the number of classes with 12–19 students, 20–27 students, and 28–35 students.
→Add the numbers.

Solution Number of classes with 12–19 students: 5
Number of classes with 20–27 students: 9
Number of classes with 28–35 students: 11
$5 + 9 + 11 = 25$
25 of the math classes have 35 or fewer students.

4. Strategy To find the percent:
→Use Exercise 1 to find the number of classes with 44–51 students and with 52–59 students.
→Add the numbers.
→Use the basic percent equation.

Solution Number of classes with 44–51 students: 4
Number of classes with 52–59 students: 2
$4 + 2 = 6$
$pB = A$
$P(40) = 6$
$p = \frac{6}{40}$
$p = 0.15$
15% of the math classes have 44 or more students.

5. Strategy To find the percent:
→Use Exercise 1 to find the number of classes with 12–19 students and with 20–27 students.
→Add the numbers.
→Use the basic percent equation.

Solution Number of classes with 12–19 students: 5
Number of classes with 20–27 students: 9
$5 + 9 = 14$
$pB = A$
$p(40) = 14$
$p = \frac{14}{40}$
$p = 0.35$
35% of the math classes have 27 or fewer students.

6. Strategy To find the number of days the temperature was 45° or above:
→Read the histogram to find the number of days the temperature was 45°–50° and the number of days the temperature was 50°–55°.
→Add the numbers.

Solution Number of days the temperature was 45°–50°: 15
Number of days the temperature was 50°–55°: 10
$15 + 10 = 25$
The temperature was 45° or above on 25 days.

7. Strategy To find the number of days the temperature was 25° or below:
→Read the histogram to find the number of days the temperature was 10°–15°, the number of days the temperature was 15°–20°, and the number of days the temperature was 20°–25°.
→Add the numbers.

Solution Number of days the temperature was 10°–15°: 2
Number of days the temperature was 15°–20°: 15
Number of days the temperature was 20°–25°: 12
$2 + 15 + 12 = 29$
The temperature was 25° or below on 29 days.

8. Strategy

To calculate the mean:
→Calculate the sum of the cholesterol levels.
→Divide by 11.
To calculate the median:
→Arrange the numbers from smallest to largest. The median is the middle number.

Solution

The sum of the numbers is 2,360.

$\bar{x} = \frac{2,360}{11} = 214.\overline{54}$

The mean of the cholesterol levels is $215.\overline{54}$.

160 180 190 200 210 210
220 230 230 250 280

The median cholesterol level is 210.

9. Strategy

To calculate the mean:
→Calculate the sum of the weights.
→Divide by 10.
To calculate the median:
→Arrange the numbers from smallest to largest.
→Because there is an even number of values, the median is the sum of the two middle numbers divided by 2.

Solution

The sum of the numbers is 71.7.

$\bar{x} = \frac{71.7}{10} = 7.17$

The mean weight of the babies is 7.17 lb.

5.6 5.9 6.3 6.5 6.9
7.2 7.2 8.1 8.9 9.1

$\text{median} = \frac{6.9 + 7.2}{2} = 7.05$

The median weight of the babies is 7.05 lb.

10. Strategy

To find the modal response:
→Find the response that was recorded most frequently.

Solution

The response "good" was mentioned most frequently and thus is the modal response.

11. Strategy

To find the number of shares:
→Read the frequency polygon to find the number of shares sold between 7 A.M.–8 A.M., 8 A.M.–9 A.M., and 9 A.M.–10 A.M.
→Add the numbers.

Solution

Number of shares sold 7 A.M.–8 A.M.: 25
Number of shares sold 8 A.M.–9 A.M.: 13
Number of shares sold 9 A.M.–10 A.M.: 17
25 + 13 + 17 = 55
55 million shares of stock were sold between 7 A.M. and 10 A.M.

12. Strategy

To find the number of shares:
→Read the frequency polygon to determine when less than 15 million shares sold.

Solution

Less than 15 million shares sold between 8 A.M. and 9 A.M.

13. Strategy

To find the ratio:
→Read the frequency polygon to find the number of shares sold between 10 A.M.–11 A.M. and between 11 A.M.–12 P.M.
→Write the ratio in lowest terms.

Solution

Number of shares sold 10 A.M.–11 A.M.: 15
Number of shares sold 11 A.M.–12 P.M.: 25

$\frac{15 \text{ million}}{25 \text{ million}} = \frac{15}{25} = \frac{3}{5}$

The ratio is $\frac{3}{5}$.

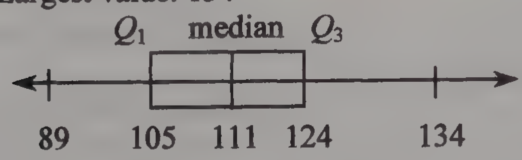
14. Strategy

To prepare the box-and-whiskers plot:
→Arrange the data from smallest to largest. Then find the median.
→Find Q_1, the median of the lower half of the data.
→Find Q_3, the median of the upper half of the data.
→Determine the smallest and largest data values.
→Draw the box-and-whiskers plot.

Solution

89 99 102 105 109 110 110 111
116 120 121 124 124 131 134

median = 111
$Q_1 = 105$
$Q_3 = 124$
Smallest value: 89
Largest value: 134



15. Strategy

To calculate the standard deviation:
→Find the mean of the average miles per gallon.
→Use the procedure for calculating the standard deviation.

Solution

$$\bar{x} = \frac{177}{6} = 29.5$$

x	$(x-\bar{x})^2$	
24	$(24-29.5)^2$	30.25
28	$(28-29.5)^2$	2.25
22	$(22-29.5)^2$	56.25
35	$(35-29.5)^2$	30.25
41	$(41-29.5)^2$	132.25
27	$(27-29.5)^2$	6.25
	Total	$= 257.5$

$$\frac{257.5}{6} \approx 42.9167$$

$\sigma = \sqrt{42.9167} \approx 6.55$
The standard deviation is 6.55.

16. Strategy

Use the probability formula.

Solution

There are 2,500 possible outcomes.
There are 5 outcomes favorable to E.

$$P(E) = \frac{\text{number of favorable outcomes}}{\text{total number of outcomes}}$$

$$P(E) = \frac{5}{2{,}500} = \frac{1}{500}$$

The probability of winning the television is $\frac{1}{500}$.

17. Strategy Use the formula for finding the odds in favor.

Solution Number of favorable outcomes: 15
Number of unfavorable outcomes: $50-15=35$
Odds in Favor $=\dfrac{\text{number of favorable outcomes}}{\text{number of unfavorable outcomes}}$
$=\dfrac{15}{35}=\dfrac{3}{7}$
The odds of the ball being red are $\dfrac{3}{7}$.

18. Strategy To calculate the probability:
→Restate the odds against as odds in favor.
→Using the odds in favor fraction, the probability of winning is the ratio of the numerator to the sum of the numerator and denominator.

Solution The odds against winning are 5 TO 2, therefore the odds in favor of winning are 2 TO 5.
Probability of winning $=\dfrac{2}{2+5}=\dfrac{2}{7}$
The probability of winning is $\dfrac{2}{7}$.

19. Strategy To calculate the probability:
→Count the number of possible outcomes.
→Count the number of favorable outcomes of the experiment *E*.
→Use the probability formula.

Solution There are 12 possible outcomes of the experiment.
There are 2 outcomes favorable to *E*: 6, 12
$P(E)=\dfrac{2}{12}=\dfrac{1}{6}$
The probability is $\dfrac{1}{6}$ that the number will be divisible by 6.

20. Strategy To calculate the probability:
→Find the number of possible outcomes.
→Find the number of favorable outcomes.
→Use the probability formula.

Solution There are $14(3+4+5+2)$ possible outcomes.
There are 5 favorable outcomes.
$P(E)=\dfrac{5}{14}$
The probability is $\dfrac{5}{14}$ that the student is a junior.

Chapter Test, pages 619–620

1. Strategy To find the number of residences where the cost was \$60 or above:
→Read the histogram to find the number of customers who had monthly cost of over \$60 was \$60–\$80 and the number of customers when the cost was \$80–\$100 and the number of customers when the cost was \$100–\$120.
→Add the numbers.

Solution Number of customers when the cost was \$60–\$80: 40
Number of customers when the cost was \$80–\$100: 15
Number of customers when the cost was \$100–\$120: 10
$40 + 15 + 10 = 65$
The number of residences having costs for telephone service of \$60 or more is 65.

2. Strategy To find the total gross sales:
→Read the frequency polygon to find the total gross sales in January and February.
→Add the numbers.

Solution Total gross sales in January: 25,000
Total gross sales in February: 30,000
$25{,}000 + 30{,}000 = 55{,}000$
The total gross sales for Jan. and Feb. was \$55,000.

3. Strategy To find the percent:
→Use the frequency table to find the number of restaurants that had annual sales between \$750,000 and \$1,000,000.
→Use the basic percent equation.

Solution Number of restaurants = 8
Percent · base = amount
$p(50) = 8$
$$p = \frac{8}{50} = 0.16$$
18% of the restaurants had annual sales between \$750,000 and \$1,000,000.

4. Strategy To find the mean bowling score:
→Determine the sum of the bowling scores.
→Divide the sum by 8.

Solution The sum of the scores is 1,223.
$$\bar{x} = \frac{1{,}223}{8} = 152.875$$
The mean bowling score is 152.875.

5. Strategy To find the median response time:
→Arrange the numbers from smallest to largest.
→The median is the middle term.

Solution 8 8 11 11 14 15 17 21 22
median = 14
The median response time is 14 minutes.

6. Strategy To find the modal response, write down the category that received the most responses.

Solution Because a response of very good was recorded most frequently, the modal response is very good.

7. Strategy To find the number to be sold:
→Let n represent the number of to be sold.
→Use the formula for the mean to solve for n.

Solution
$$35 = \frac{34+28+31+36+38+n}{6}$$
$210 = 167 + n$
$43 = n$
In the sixth month, 43 phones must be sold.

8. Strategy To find the first quartile:
→Arrange the data from smallest to largest, and then find the median.
→Find Q_1, the median of the lower half of the data.

Solution 6.5 8.6 9.3 9.8 9.8 10.5 10.5 11.2 11.9 17.3 18.5 19.6 20.3 2.10
$$\text{median} = \frac{10.5+11.2}{2} = 10.85$$
$Q_1 = 9.8$
The first quartile is 9.8.

9. Strategy To find the range, subtract the smallest value from the largest value.
To find the median, look at the median of the box-and-whisker plot.

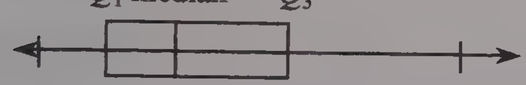
Solution $26 - 4 = 22$
The range is 22.
The median is 14 vacation days.

10. Strategy To draw the box-and-whiskers plot:
→Arrange the data from smallest to largest, and then find the median.
→Find Q_1, the median of the lower half of the data.
→Find Q_3, the median of the upper half of the data.
→Determine the smallest and largest data values.
→Draw the box-and-whiskers plot.

Solution 68 69 70 70 70 71 72
73 73 74 74 75 76 80

$$\text{median} = \frac{72+73}{2} = 72.5$$

$Q_1 = 70$
$Q_3 = 74$
Smallest value: 68
Largest value: 80



11. Strategy To calculate the standard deviation:
→Find the mean number of incorrect answers.
→Use the procedure for calculating standard deviation.

Solution $$\bar{x} = \frac{2+0+3+1+0+4+5+1+3+1}{10} = \frac{20}{10} = 2$$

x	$(x-\bar{x})^2$	
2	$(2-2)^2$	0
0	$(0-2)^2$	4
3	$(3-2)^2$	1
1	$(1-2)^2$	1
0	$(0-2)^2$	4
4	$(4-2)^2$	4
5	$(5-2)^2$	9
1	$(1-2)^2$	1
3	$(3-2)^2$	1
1	$(1-2)^2$	1
	Total	= 26

$$\frac{26}{10} = 2.6$$

$\sigma = \sqrt{2.6} \approx 1.61$
The standard deviation of the number of incorrect answers is approximately 1.61.

12. The possible outcomes of tossing a coin and then a regular die: (H, 1), (H, 2), (H, 3), (H, 4), (H, 5), (H, 6), (T, 1), (T, 2), (T, 3), (T, 4), (T, 5), (T, 6). There are 12 elements in the sample space:

13. The possible outcomes of stacking a nickel, dime and quarter: (N, D, Q), (N, Q, D), (D, N, Q), (D, Q, N), (Q, N, D), (Q, D, N)

14. Strategy To calculate the probability:
→Find the number of possible outcomes.
→Find the number of favorable outcomes.
→Use the probability formula.

Solution There are 248(14 + 32 + 202) possible outcomes.
There are 32 favorable outcomes.

$$P(E) = \frac{32}{248} = \frac{4}{31}$$

The probability is $\frac{4}{31}$ that the person is in business class.

15. Strategy To calculate the probability:
→Find the number of possible outcomes.
→Find the number of favorable outcomes.
→Use the probability formula.

Solution There are 6 possible outcomes: (A, K, Q), (A, Q, K), (K, A, Q), (K, Q, A), (Q, A, K), (Q, K, A).
There are 2 favorable outcomes.

$$P(E) = \frac{2}{6} = \frac{1}{3}$$

The probability is $\frac{1}{3}$ that the ace is on top of the stack.

16. Strategy To calculate the probability:
→Find the number of possible outcomes.
→Find the number of favorable outcomes.
→Use the probability formula.

Solution There are 8 possible outcomes.
There is 1 favorable outcomes.

$$P(E) = \frac{1}{8}$$

The probability is $\frac{1}{8}$ that the student will answer all three questions correctly.

17. Strategy To calculate the probability:
→Find the number of possible outcomes.
→Find the number of favorable outcomes.
→Use the probability formula.

Solution There are 45(15 + 20 + 10) possible outcomes.
There are 30(20 + 10) favorable outcomes.

$$P(E) = \frac{30}{45} = \frac{2}{3}$$

The probability is $\frac{2}{3}$ that the seed is not for a red flower.

18. Strategy To calculate the probability of winning by using the odds in favor fraction, the probability of winning is the ratio of the numerator to the sum of the numerator and denominator.

Solution Probability of winning:

$$\frac{1}{1+12} = \frac{1}{13}$$

The probability of winning the lottery is $\frac{1}{13}$.

19. Strategy To find the odds:
→Find the unfavorable outcomes.
→Use the odds in favor of an event formula.

Solution There is 1 favorable outcome.
There are 8(9 –1) unfavorable outcomes:

$$\text{Odds in favor} = \frac{1}{8}$$

The odds of in favor of rolling a nine is 1 TO 8.

20. Strategy To calculate the probability:
→Find the number of possible outcomes.
→Find the number of favorable outcomes.
→Use the probability formula.

Solution There are 12 possible outcomes
There are 5 favorable outcomes

$$P(E)=\frac{5}{12}$$

The probability is $\frac{5}{12}$ that the number on the upward face is less than six.

Cumulative Review Exercises, pages 621–622

1. $\sqrt{200}=\sqrt{100\cdot 2}=\sqrt{100}\cdot\sqrt{2}=10\sqrt{2}$

2. $7p-2(3p-1)=5p+6$
$7p-6p+2=5p+6$
$p+2=5p+6$
$p-5p+2=5p-5p+6$
$-4p+2=6$
$-4p+2-2=6-2$
$-4p=4$
$\frac{-4p}{-4}=\frac{4}{-4}$
$p=-1$
The solution is –1.

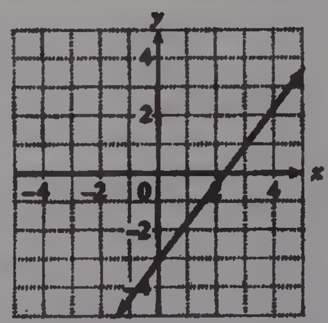
3. $3a^2b-4ab^2$
$3(-1)^2(2)-4(-1)(2^2)$
$=3(1)(2)-4(-1)(4)$
$=3(2)-4(-1)(4)$
$=6-4(-1)(4)$
$=6-(-4)(4)$
$=6-(-16)$
$=6+16$
$=22$

4. $-2[2-4(3x-1)+2(3x-1)]$
$=-2[2-12x+4+6x-2]$
$=-2[-6x+4]$
$=12x-8$

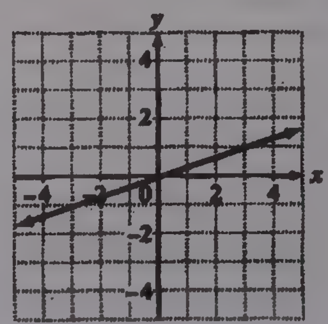
5. $-\frac{2}{3}y-5=7$
$-\frac{2}{3}y-5+5=7+5$
$-\frac{2}{3}y=12$
$-\frac{3}{2}\left(-\frac{2}{3}\right)y=-\frac{3}{2}(12)$
$y=-18$
The solution is –18.

6. $-\frac{4}{5}\left(\frac{3}{4}-\frac{7}{8}-\left(\frac{2}{3}\right)^2\right)=-\frac{4}{5}\left(\frac{3}{4}-\frac{7}{8}-\frac{4}{9}\right)$
$=-\frac{4}{5}\left(\frac{54}{72}-\frac{63}{72}+\frac{-32}{72}\right)$
$=-\frac{4}{5}\left(\frac{54-63-32}{72}\right)$
$=-\frac{4}{5}\left(\frac{-41}{72}\right)$
$=\frac{41}{90}$

7.



8.



9. $(7y^2+5y-8)-(4y^2-3y+1)$
$=(7y^2+5y-8)+(-4y^2+3y-1)$
$=3y^2+8y-9$

10. $(4a^2b)^3=4^{1\cdot 3}a^{2\cdot 3}b^{1\cdot 3}=4^3a^6b^3$
$=64a^6b^3$

11. Strategy To find the base, solve the basic percent equation.
Percent $=16\frac{2}{3}\%=\frac{50}{300}=\frac{1}{6}$,
base $=n$, amount $=24$.

Solution Percent · base = amount

$\frac{1}{6}n = 24$

$\left(\frac{6}{1}\right)\left(\frac{1}{6}\right)n = \left(\frac{6}{1}\right)(24)$

$n = 144$

$16\frac{2}{3}\%$ of 144 is 24.

12. $\frac{9}{8} = \frac{3}{n}$

$9n = 8(3)$

$9n = 24$

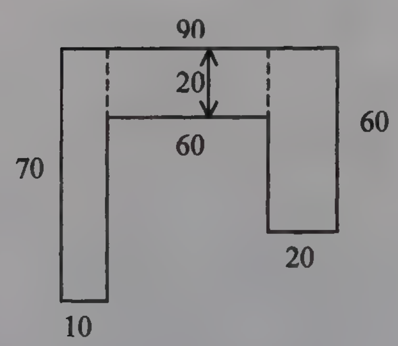
$n = \frac{24}{9}$

$n = \frac{8}{3}$

The solution is $\frac{8}{3}$.

13. $87{,}600{,}000{,}000 = 8.76 \times 10^{10}$

14. Strategy The area of the composite figure is equal to the area of three rectangles, as shown in the figure.



Solution $A = LW$

$A_1 = 70(10) = 700$

$A_2 = 20(60) = 1{,}200$

$A_3 = 20(60) = 1{,}200$

$A = 700 + 1{,}200 + 1{,}200$

$A = 3{,}100$

The area of the patio is 3,100 ft^2.

15. $(5c^2d^4)(-3cd^6)$

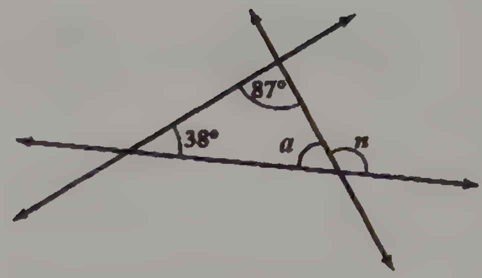
$= [5(-3)](c^{2+1})(d^{4+6})$

$= -15c^3d^{10}$

16. 40 km/h

$= \frac{40\text{ km}}{1\text{ h}} \cdot \frac{1{,}000\text{ m}}{1\text{ km}} \cdot \frac{1\text{ h}}{3{,}600\text{ s}} = 11.\overline{1}\text{ m/s}$

17. Strategy



→To find the measure of $\angle a$, use the fact that the sum of the interior angles of a triangle is 180°.

→To find the measure of $\angle n$, use the fact that the sum of an interior and an exterior angle is 180°.

Solution $38° + 87° + \angle a = 180°$

$125° + \angle a = 180°$

$\angle a = 55°$

$\angle a + \angle n = 180°$

$55° + \angle n = 180°$

$\angle n = 125°$

The measure of $\angle n$ is 125°.

18. Strategy To find the area, use the formula for the area of a parallelogram. Substitute 8 for b and 4 for h. Solve for A.

Solution $A = bh$

$A = 8(4)$

$A = 32$

The area of the parallelogram is 32 m^2.

19. Strategy To find the simple interest, solve the formula $I = Prt$ for I.

$P = 25{,}000$, $r = 0.075$, $t = \frac{3}{12}$

Solution $I = Prt$

$I = 25{,}000(0.075)\left(\frac{3}{12}\right)$

$I = 468.75$

The simple interest on the loan is \$468.75.

20. Strategy To calculate the probability:
→Count the number of possible outcomes of the experiment.
→Count the number of outcomes that are favorable to the event of the ball is not white.
→Use the probability formula.

Solution There are 36(12 + 15 + 9) possible outcomes.
There are 24(15 + 9) outcomes favorable to E.
$P(E)=\frac{24}{36}=\frac{2}{3}$
The probability is $\frac{2}{3}$ that the ball is not white.

21. Strategy To calculate the mean score:
→Calculate the sum of the scores.
→Divide by the number of scores.
To find the median score:
→Arrange the scores from smallest to largest.
→Because there is an even number of values, the median is the sum of the two middle numbers divided by 2.

Solution The sum of the numbers is 186.
$\bar{x}=\frac{186}{6}=31$
The mean score on the six tests is 31.
22 24 31
34 37 38
$\text{median}=\frac{31+34}{2}=32.5$
The median score on the six tests is 32.5.

22. Strategy To find the percent:
→Find the number of registered voters who did not vote.
→Use the basic percent equation.
Percent = n, base = 230,000, amount = number who did not vote.

Solution 230,000 – 55,000 – 175,000
percent · base = amount
$n \cdot 230{,}000 = 175{,}000$
$n=\frac{175{,}000}{230{,}000}$
$n \approx 0.761$
76.1% of the registered voters did not vote.

23. Strategy To find the circumference of the earth, write and solve a proportion using n to represent the circumference.

Solution $\frac{7.5}{360}=\frac{1{,}600}{n}$
$7.5n = 360(1{,}600)$
$7.5n = 576{,}000$
$n=\frac{576{,}000}{7.5}$
$n = 76{,}800$
The circumference of the earth is approximately 76,800 km.

24. Strategy To find the standard deviation:
→Find the mean of the rainfall totals.
→Use the procedure for calculating the standard deviation.

Solution $\bar{x} = \dfrac{12+16+20+18+14}{5}$

$= 16$

x	$(x-\bar{x})^2$	
12	$(12-16)^2$	16
16	$(16-16)^2$	0
20	$(20-16)^2$	16
18	$(18-16)^2$	4
14	$(14-16)^2$	4
	Total	$= 40$

$\dfrac{40}{5} = 8$

$\sigma = \sqrt{8} = 2.83$

The standard deviation of the rainfall totals is 2.83.

25. Strategy To find the wage before the increase, write and solve an equation, using n to represent the wage before the increase.

Solution $0.10n + n = 16.50$

$1.10n = 16.50$

$n = \dfrac{16.50}{1.10}$

$n \approx 15.00$

The hourly wage before the increase was $15.00 per hour.

FINAL EXAMINATION, pages 623–626

1.
$$\begin{array}{rcr} 672 & \rightarrow & 700 \\ 843 & \rightarrow & 800 \\ 509 & \rightarrow & 500 \\ 417 & \rightarrow & +400 \\ \hline & & 2{,}400 \end{array}$$

2. $18 + 3(6-4)^2 \div 2 = 18 + 3(2)^2 \div 2$

$= 18 + 3(4) \div 2$

$= 18 + 12 \div 2$

$= 18 + 6$

$= 24$

3. $-8 - (-13) - 10 + 7 = -8 + 13 + (-10) + 7$

$= 5 + (-10) + 7$

$= -5 + 7$

$= 2$

4. $|a-b| - 3bc^3$

$|-2-4| - 3(4)(-1)^3 = |-6| - 3(4)(-1)^3$

$= 6 - 3(4)(-1)^3$

$= 6 - 3(4)(-1)$

$= 6 - (12)(-1)$

$= 6 - (-12)$

$= 6 + 12$

$= 18$

5. $5\frac{3}{8} - 2\frac{11}{16} = 5\frac{6}{16} - 2\frac{11}{16}$

$= 4\frac{22}{16} - 2\frac{11}{16}$

$= 2\frac{11}{16}$

6. $\frac{7}{9} \div \frac{5}{6} = \frac{7}{9} \cdot \frac{6}{5}$

$= \dfrac{7 \cdot 6}{9 \cdot 5}$

$= \dfrac{7 \cdot 2 \cdot 3}{3 \cdot 3 \cdot 5}$

$= \dfrac{14}{15}$

7. $\dfrac{\frac{3}{4} - \frac{1}{2}}{\frac{5}{8} + \frac{1}{2}} = \dfrac{\frac{3}{4} - \frac{2}{4}}{\frac{5}{8} + \frac{4}{8}}$

$= \dfrac{\frac{1}{4}}{\frac{9}{8}} = \frac{1}{4} \div \frac{9}{8}$

$= \frac{1}{4} \cdot \frac{8}{9}$

$= \dfrac{1 \cdot 8}{4 \cdot 9}$

$= \dfrac{1 \cdot 2 \cdot 2 \cdot 2}{2 \cdot 2 \cdot 3 \cdot 3}$

$= \dfrac{2}{9}$

8. $\frac{5}{16} = 0.3125$

$0.3125 < 0.313$

$\frac{5}{6} < 0.313$

9. $-10qr$

$-10(-8.1)(-9.5) = 81(-9.5)$

$= -769.5$

10. $-15.32 \div 4.67 \approx -3.28$

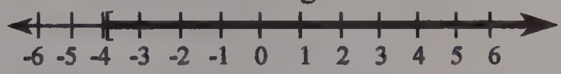
11.
$$\begin{array}{c|c} \multicolumn{2}{c}{-90y = 45} \\ \hline -90(-0.5) & 45 \end{array}$$

$45 = 45$

Yes, -0.5 is a solution of the equation.

12. $\sqrt{162} = \sqrt{81 \cdot 2}$
$= \sqrt{81} \cdot \sqrt{2}$
$= 9\sqrt{2}$

13. Draw a bracket at –4.
Draw a heavy line to the right of –4.
Draw an arrow at the right of the line.



14. $-\frac{5}{6}(-12t) = 10t$

15. $2(x - 3y) - 4(x + 2y) = 2x - 6y - 4x - 8y$
$= (2x - 4x) + (-6y - 8y)$
$= -2x - 14y$

16. $\left(5z^3 + 2z^2 - 1\right) - \left(4z^3 + 6z - 8\right)$
$= \left(5z^3 + 2z^2 - 1\right) + \left(-4z^3 - 6z + 8\right)$
$= z^3 + 2z^2 - 6z + 7$

17. $\left(4x^2\right)\left(2x^5y\right) = (4 \cdot 2)\left(x^{2+5}\right)(y) = 8x^7y$

18. $2a^2b^2\left(5a^2 - 3ab + 4b^2\right)$
$= 2a^2b^2\left(5a^2\right) - \left(2a^2b^2\right)(3ab)$
$+ \left(2a^2b^2\right)\left(4b^2\right)$
$= 10a^4b^2 - 6a^3b^3 + 8a^2b^4$

19. $(3x - 2)(5x + 3)$
$= 3x(5x) + 3x(3) - 2(5x) - 2(3)$
$= 15x^2 + 9x - 10x - 6$
$= 15x^2 - x - 6$

20. $\left(3x^2y\right)^4 = 3^{1\cdot 4}x^{2\cdot 4}y^{1\cdot 4} = 3^4x^8y^4$
$= 81x^8y^4$

21. $4^{-3} = \frac{1}{4^3} = \frac{1}{64}$

22. $\frac{m^5n^8}{m^3n^4} = m^{5-3}n^{8-4} = m^2n^4$

23. $2 - \frac{4}{3}y = 10$
$2 - 2 - \frac{4}{3}y = 10 - 2$
$-\frac{4}{3}y = 8$
$\left(-\frac{3}{4}\right)\left(-\frac{4}{3}\right)y = -\frac{3}{4}(8)$
$y = -6$
The solution is –6.

24. $6z + 8 = 5 - 3z$
$6z + 3z + 8 = 5 - 3z + 3z$
$9z + 8 = 5$
$9z + 8 - 8 = 5 - 8$
$9z = -3$
$\frac{9z}{9} = \frac{-3}{9}$
$z = -\frac{1}{3}$
The solution is $-\frac{1}{3}$.

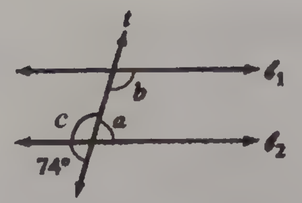
25. $8 + 2(6c - 7) = 4$
$8 + 12c - 14 = 4$
$12c - 6 = 4$
$12c - 6 + 6 = 4 + 6$
$12c = 10$
$\frac{12c}{12} = \frac{10}{12}$
$c = \frac{5}{6}$
The solution is $\frac{5}{6}$.

26. 2.48m = 248 cm

27. $2.6 \text{ mi} = \frac{2.6 \text{ mi}}{1} \cdot \frac{5{,}280 \text{ ft}}{1 \text{ mi}} = 13{,}728 \text{ ft}$

28. $\frac{n+2}{8} = \frac{5}{12}$
$(n + 2) \cdot 12 = 8 \cdot 5$
$12n + 24 = 40$
$12n = 16$
$n = \frac{16}{12}$
$n = \frac{4}{3}$
The solution is $\frac{4}{3}$.

29. Strategy



→To find the measure of $\angle a$, use the fact that $\angle a$ and the 74° angle are vertical angles.
→Find the measure of $\angle c$ by using the fact that adjacent angles of intersecting lines are supplementary.
→To find the measure of $\angle b$, use the fact that $\angle b$ and $\angle c$ are alternate interior angles of parallel lines.

Solution
$\angle a = 74°$
$\angle a + \angle c = 180°$
$74° + \angle c + 180°$
$\angle c = 106°$
$\angle b = 106°$
The measure of $\angle a$ is 74°.
The measure of $\angle b$ is 106°.

30. Strategy
To find the hypotenuse, use the Pythagorean Theorem.
$a = 7, b = 8.$

Solution
$c^2 = a^2 + b^2$
$c^2 = 7^2 + 8^2$
$c^2 = 49 + 64$
$c^2 = 113$
$c = \sqrt{113}$
$c \approx 10.6$
The length of the hypotenuse is approximately 10.6 ft.

31. Strategy
The perimeter is equal to three sides of a rectangle plus one half the circumference of a circle.

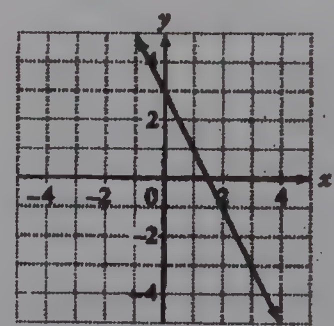
Solution
$P = 2L + W + \frac{1}{2}\pi d$
$P = 2(7) + 6 + \frac{1}{2}\pi(6)$
$P = 14 + 6 + 3\pi$
$P = 20 + 3\pi$
$P \approx 29.42$
The perimeter is approximately 29.42 cm.

32. Strategy
The volume is equal to the volume of the rectangular solid minus one half the volume of the cylinder. The radius of the cylinder is one half the diameter of the cylinder.

Solution
$r = \frac{1}{2}d = \frac{1}{2}(1) = \frac{1}{2}$
$V = LWH - \frac{1}{2}\pi r^2 h$
$V = 8(4)(3) - \frac{1}{2}\pi\left(\frac{1}{2}\right)^2(8)$
$V = 96 - \pi$
$V \approx 92.86$
The volume of the solid is approximately 92.86 in^3.

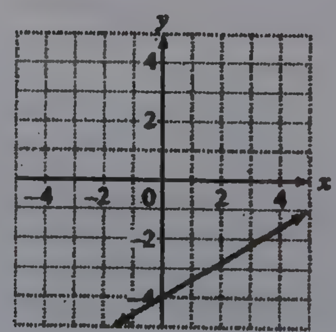
33.

x	y
−1	5
1	1
3	−3



34.

x	y
0	−4
5	−1
2	$-2\frac{4}{5}$



35. Strategy To find the ground speed, substitute 22 for h and 386 for a in the given formula and solve for g.

Solution
$g = a - h$
$g = 386 - 22$
$g = 364$
The ground speed of the airplane is 364 mph.

36. Strategy To find the number products:
→Convert 8 h to minutes using the conversion factor $\frac{60 \text{ min}}{1 \text{ h}}$.
→Divide the total number of minutes by $1\frac{1}{2}$.

Solution
$8 \text{ h} = \frac{8 \text{ h}}{1} \cdot \frac{60 \text{ min}}{1 \text{ h}} = 480 \text{ min}$
$480 \div 1\frac{1}{2} = 480 \div \frac{3}{2}$
$= 480 \cdot \frac{2}{3}$
$= 320$
The worker can inspect 320 products in one day.

37. Strategy To find the difference, subtract the melting point of bromine (–7.2°) from the boiling point of bromine (58.78°).

Solution
$58.78° - (-7.2°)$
$= 58.78° + 7.2°$
$= 65.98°$
The difference between the melting point and the boiling point is 65.98°C.

38. $5,880,000,000,000 = 5.88 \times 10^{12}$

39. Strategy The distance of the fulcrum from the 50-pound child: x
The distance of the fulcrum from the 75-pound child: $10 - x$
To find the placement of the fulcrum, replace the variables F_1, F_2, and d by the given variables and solve for x.

Solution
$F_1 x = F_2(d - x)$
$50 \cdot x = 75(10 - x)$
$50x = 750 - 75x$
$125x = 750$
$x = \frac{750}{125}$
$x = 6$
The fulcrum is 6 ft from the 50-pound child.

40. Strategy To find the number of tickets, write and solve an equation, using x to represent the number of tickets.

Solution
$5.50 + 22.50x = 140.50$
$22.50x = 135$
$x = \frac{135}{22.50}$
$x = 6$
You purchased 6 tickets.

41. Strategy To find the property tax, write and solve a proportion using n to represent the amount of tax.

Solution
$\frac{3,750}{125,000} = \frac{n}{157,000}$
$3,750(157,000) = 125,000(n)$
$588,750,000 = 125,000n$
$\frac{588,750,000}{125,000} = n$
$4,710 = n$
The property tax is \$4,710.

42. Strategy To find the percent of the states that have a land area of 75,000 mi^2 or more:
→Add the number of states that have a land area of 75,000–100,000 mi^2 (8) and the number that have a land area of 100,000 mi^2 (8).
→Use the basic percent equation.
Percent = n, base = 50, amount = the sum found in Step 1

Solution $8 + 8 = 16$
Percent · base = amount
$n \cdot 50 = 16$
$n = \frac{16}{50}$
$n = 0.32 = 32\%$
32% of the states have a land area of 75,000 mi^2 or more.

43. Strategy To find the revolutions per minute:
→Write the basic inverse variation equation, replace the variables by the given values, and solve for k.
→Write the inverse variation equation, replacing k by its value. Substitute 24 for the number of teeth and solve for the number of revolutions per minute.

Solution $s = \frac{k}{t}$
$12 = \frac{k}{32}$
$12(32) = k$
$384 = k$
$s = \frac{384}{t}$
$s = \frac{384}{24}$
$s = 16$
The gear will make 16 revolutions per minute.

44. Strategy To find the total cost of the car:
→Find the sales tax by using the basic percent equation. Percent = 5.5% = 0.055, base = 12,500, amount = n
→Add the tax to 12,500.

Solution Percent · base = amount
$0.055(12{,}500) = n$
$687.50 = n$
$687.50 + 12{,}500 = 13{,}187.50$

45. Strategy To find the percent decrease:
→Subtract 96 from 124 to find the decrease.
→Use the basic percent equation.
Percent = n, base = 124, amount = the decrease.

Solution $124 - 96 = 28$
Percent · base = amount
$n \cdot 124 = 28$
$n = \frac{28}{124}$
$n \approx 0.226$
The housing starts decreased approximately 22.6%.

46. Strategy To find the sale price, solve the formula
$S = (1 - r)R$ for S.
$r = 35\%$, $R = 245$.

Solution $S = (1 - r)R$
$S = (1 - 0.35)(245)$
$S = 0.65(245)$
$S = 159.25$
The sale price of the necklace is $159.25.

47. Strategy To find the simple interest, solve the formula $I = Prt$ for I.
$P = 25{,}000$ $r = 0.086$,
$t = \frac{9}{12}$.

Solution $I = Prt$
$I = 25{,}000(0.086)\left(\frac{9}{12}\right)$
$I = 1{,}612.50$
The interest on the loan is $1,612.50.

48. Strategy To find the percent:
→Use the line graph to find the number of students that work more than 15 hours per week.
→Solve the basic percent equation for percent.

Solution Number of students who work 15–20 h: 15
Number of students who work 20–25 h: 10
Number of students who work 25–30 h: 5
Total $15 + 10 + 5 = 30$
Percent · base = amount
$p(80) = 30$
$p = \frac{30}{80}$
$p = 0.375$
37.5% of the students work more than 15 h per week.

49. Strategy

To calculate the mean rate:
→Calculate the sum of the rates for the insurance.
→Divide by the number of quotes.
To calculate the median rate:
→Arrange the numbers from smallest to largest.
→The median is the middle number.

Solution

The sum of the rates is 1,674.
$\bar{x} = \frac{1{,}674}{5} = 334.8$
The mean rate for the insurance is \$334.80.
281 297 309
362 425
median = 309
The median rate for the insurance is \$309.

50. Strategy

To calculate the probability:
→Refer to the table on page 606 to count the number of possible outcomes.
→Count the outcomes of the experiment that are favorable to the event that the sum is divisible by 3.
→Use the probability formula

Solution

There are 36 possible outcomes of the experiment.
There are 12 outcomes favorable to E:
(1, 2), (2, 1), (1, 5), (2, 4), (3, 3), (4, 2), (5, 1), (3, 6), (4, 5), (5, 4), (6, 3), (6, 6)
$P(E) = \frac{12}{36} = \frac{1}{3}$
The probability is $\frac{1}{3}$ that the sum will be divisible by 3.

HOUGHTON MIFFLIN
New Ways to Know

ISBN 0-618-24994-X
90000
9 780618 249947

N-0088